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TWO DESTRUCTIVE LEAF DISEASES OF CELERY IN THE PHILIPPINES [1]

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The two leaf diseases of celery (*Apium graveolens* L.) commonly known in the United States as "late blight," and "early blight," are the two most destructive fungous maladies of celery observed in the Philippines. Late blight is a very common disease of American celery (*A. graveolens* L. var. *dulce*) that is raised mainly in and around Baguio, Mountain Province, where the climate is semi-temperate. Early blight, on the other hand, is the serious malady of green celery ("kinchay") (*Apium graveolens* L.), which is grown mostly in Chinese gardens in and near Manila. This disease was recently found by Dr. Fajardo seriously attacking the American celery grown at the experimental plots in Lipa, Batangas. With the exception of brief notes made by Fajardo(16) on late blight and by Reinking(35) on early blight, no studies have heretofore been reported on these diseases in the Philippines. As these diseases are serious in the localities where they are found the main purpose of this paper is to describe them and their causal fungi and to suggest control measures which may be of practical value to local celery growers.

[1] This investigation was conducted while the writers were still connected with the division of botany, Bureau of Science, Manila.

THE LATE BLIGHT DISEASE

HISTORY, GEOGRAPHIC DISTRIBUTION, HOSTS, AND ECONOMIC IMPORTANCE

The first authentic report on late blight of celery was made in 1890 in Italy by Briosi and Cavara.(8) The disease was first recognized in the United States in 1891 in the Eastern States, (6, 21, 22), whence it spread across the continent until it was reported in 1897 to be a serious menace in California.(36) At present it is found in all celery-growing sections in the United States, causing considerable damage especially in Michigan,(11) California,(8, 37) Ohio,(45) and New York.(15)

In Europe, it is also widely distributed and has been reported as serious in the British Isles,(7) Germany,(17, 23) Holland,(38) Italy,(3) and Czechoslovakia.(39) The available literature shows that it is present also in Bermuda,(30, 45) Argentina,(40) Kenya, East Africa,(28) and Western Australia.(4) Since the disease is seed-borne, it probably occurs in any country where celery is extensively grown.

In the Philippines no hosts aside from celery were found to be attacked by late blight. According to Chupp(8) late blight attacks only celery and celeriac (*Apium graveolens* L. var. *rapaceum* D. C.). Pethybridge(34) recorded the disease on wild celery. Laibach(27) and Thomas(43) tried the causal organism on various members of Umbelliferae without success. Cochran(9) inoculated several species of Umbelliferae but he succeeded in reproducing the disease only on celery and celeriac.

In the Philippines late blight has been observed only in the Mountain Province. Its origin is not known, but since celery is an introduced crop, the disease was probably carried with the seeds imported into that locality. It now causes from 80 to 100 per cent infection in the field or in the greenhouse,(16) and when infection takes place early, while the plants are young, and under extremely favorable conditions, a complete loss of the crop is sometimes experienced by the growers. A severe infection on mature plants occurring late in the season may cause a loss of from 10 to 20 per cent of the crop due to culling of the stalks.

SYMPTOMS

The celery plant is susceptible at any stage of development. The disease manifests itself first as small, circular, water-soaked, yellow spots on either surface of the lower outer leaves. These spots gradually enlarge into irregular, brown lesions, usually 2.0 to 3.0 millimeters in diameter. Under conditions favorable

for the development of the disease, the fungus spreads rapidly, causing the lesions to merge into large irregular blighted areas (Plate 1, fig. 1) which may cover the entire surface of the leaflets and finally kill the leaves. Within the spots or the blighted areas numerous, minute, rusty-brown to blackish brown pustules (Plate 1, fig. 1) develop. These pustules are the fruiting bodies or pycnidia of the causal fungus. Frequently the entire leaflets that has been killed by the disease is heavily studded by these fruiting bodies. In many cases, especially when the infection is severe, the petioles are also attacked by the fungus forming on them long, narrow, sunken spots, usually 5.0 to 8.0 millimeters in length. These spots tend to converge and later cover the greater part of the leaf stalk. Soon after the disease has gained a foot-hold on the lower outer leaves, the fungus spreads toward the inner younger leaves, producing lesions similar to those described above. Young plants heavily attacked by late blight become stunted (Plate 2, fig. 1) and fail to produce a salable crop, while older plants that are lightly infected do not lose materially in value.

CAUSAL ORGANISM

The late blight is caused by a fungus belonging to the group known as Fungi Imperfecti.

The mycelial threads are found within the host tissues. They are hyaline, or slightly colored, irregular or gnarly and septate. The pycnidia are minute, blackish-brown bodies, which are produced in abundance on the old blighted areas on both surfaces of the leaves and on the petiole. They are either globose or globose-depressed, ostiolate, stout-walled, measuring from 76.0 to 152.0 μ in diameter with an average of 124.2 μ. The spores or pycnospores are produced in the pycnidia (Plate 3, fig. 1). They are cylindrical, narrowly elongate, straight or slightly curved, usually attenuate toward the tips and truncate or slightly pointed at the bases (Plate 3, fig. 2). They are hyaline, 1- to 5-septate, measuring from 15.0 to 50.0 μ in length and from 1.6 to 3.0 μ in width, and are on the average 34.6 μ long and 2.4 μ wide. Under favorable conditions these spores later ooze out of the ostiole of the pycnidium and are subsequently scattered by various agents to neighboring plants.

In recent years two species of *Septoria* have been recognized as the cause of late blight on celery.(9, 12) Cochran(9) distinguished and proved by inoculation these two forms of late blight which he designated as the large-spot type caused by *Septoria*

apii (Br. and Cav.) Chester and the small-spot type caused by *Septoria apii-graveolentis* Dor. Cochran's(9) measurements of pycnidia and spores of the two forms are as follows:

Small-spot type: Pycnidia, 73–147 μ; spores, 22.5–58.5 × 1.5–3.0 μ.
Large-spot type: Pycnidia, 65–95 μ; spores, 13.5–34.2 × 1–2.5 μ.

From the above measurements it appears that the Philippine late blight fungus is more closely related to the small-spot type than to the large-spot type. Furthermore, the pycnidia and spores of the Philippine late blight organism are morphologically similar to those of the small-spot type. Also, the spots as observed on the leaves and stalks in the field are identical with those of the small-spot type caused by *Septoria apii-graveolentis* Dor.

RELATION OF WEATHER CONDITIONS TO THE LATE BLIGHT DISEASE

The prevalence or severity of late blight is greatly influenced by weather conditions. Cool temperature, high humidity and long period of rainy weather are more conducive to the development of the disease than dry hot weather.

Krout(25) states that the late blight on celery in New Jersey may appear as early as July, but it seldom does much damage until the cool wet days of September and October when the plants are mature. Similar observations were recorded by Wilson and Newhall(46) for late blight in Ohio. Foster and Weber(18) state that in Florida the disease is generally severe on young plants during the fall and winter, but of no consequence late in the season when the weather becomes warmer. In Baguio the disease has been observed all the year round(16) and it does most damage during the period from the middle of May to July, when rains occur frequently. In March and April when the days are warm and dry, late blight infection is light.

No specific data were found in literature to show the optimum temperature for development of late blight on celery in the field. Several authors who have studied the relation of temperature to the growth of late blight fungus, found that low temperature favors excellent growth while high temperature retards or checks the growth of the fungus. According to Chupp (8) and Flachs(17) Septoria thrives well at temperatures ranging from 15° to 21° C. Thomas(43) and Campanile(3) found that it grows better at from 13° to 19° C. than at from 22° to 25° C. Owens(33) states that this fungus thrives best between

15.5° and 21° C. Cochran(9) found that the large spot type Septoria grows at temperatures between 10° and 27° C. with an optimum of between 22° and 24° C. while the small-spot type Septoria grows at temperatures between 14° and 25° C. with an optimum of 18° to 22° C.

Text fig. 1 shows the monthly mean temperatures of Baguio, Mountain Province, and of Manila, for 1932. Baguio has for its

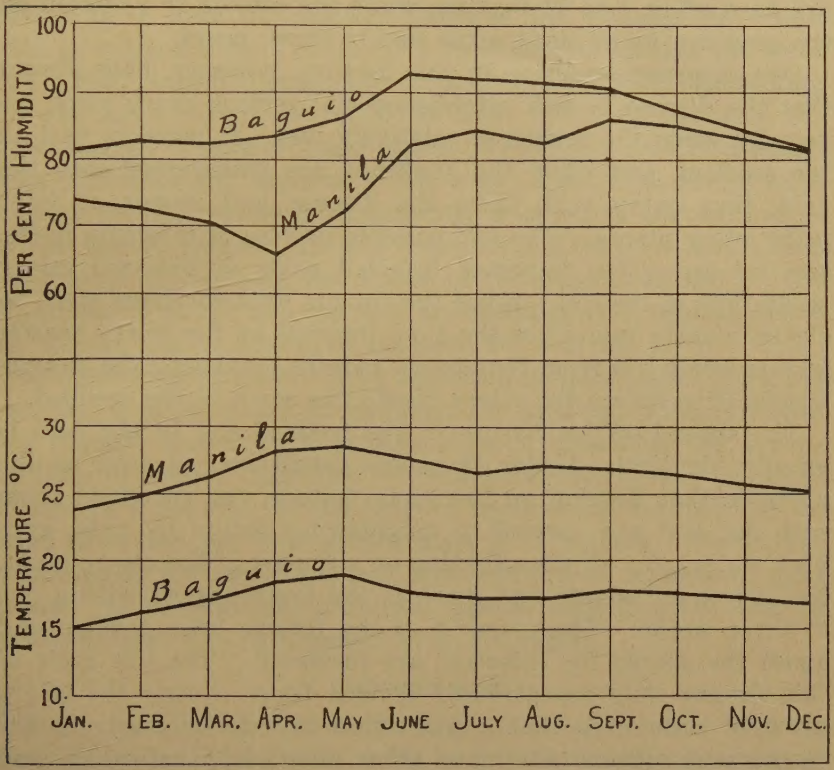

FIG. 1. Graphs showing the average monthly humidity and mean temperature for Baguio and Manila in 1932. Prepared from Philippine Weather Bureau meterological data.

average minimum temperature 14.4° C and for its average maximum temperature, 22.9° C. These temperatures fall within the limits of temperatures given by various authors for the growth of Septoria. From these data it is evident that the climate of Baguio is always favorable for the development of the late blight disease, while in Manila, where the temperature is on the average 8.4° to 8.7° C. higher than in Baguio, the disease is not found.

Since the relative humidity of Manila is sufficiently high to support the development of the disease in certain months of the year, its absence there is probably due to high temperature.

SOURCE OF INFECTION IN THE SEEDBED AND IN THE FIELD

No experiments have been conducted to determine how long the fungus lives in the infected celery refuse. Krout(26) and Flachs,(17) however, found that the conidia in celery leaves are dead after, 8 to 11 months, while the conidia in pycnidia on the seed are found dead after two to three years.

Our observations made in this locality, however, have shown that the disease is well established and serious every year, especially when the season is relatively wet. It appears first in the seedbed, and when the seedlings are transferred into the field, they carry with them the disease and sooner or later infect other plants. The two possible sources of infection in the seedbed are either imported infected seeds or diseased celery refuse left in the soil. Since the fungus lives for from eight to eleven months and since the time interval of the celery season in this locality is from four to six months, obviously the fungus is still alive before the celery plants are sown in the seedbed.

The spread of the disease in the seedbed and in the field is usually identical. Under favorable conditions, as soon as the pycnidia that develop on the spots mature, the spores in them ooze out and are carried to neighboring plants by rain, running water, etc. Upon alighting on any part of the celery plant, the spores germinate and produce the typical spots within one to three weeks. The pycnidia of the fungus later develop and again the spores for infection are produced. The life cycle of this fungus may repeat itself several times during the celery growing season, so that a plant that is infected early in the season may contaminate many other plants long before the end of the season.

CONTROL

Since this disease is well studied in other countries, and since the climatic conditions and the type of fungus associated with the disease are identical alsewhere, the following control measures which proved satisfactory elsewhere should be tried or adapted in Trinidad Valley:

1. SANITARY MEASURES

Seed disinfection.—Since the pathogene is carried with the seed, it is absolutely necessary to disinfect the seeds, especially if they are not guaranteed to be disease-free. In localities where

the disease is well established, seed disinfection alone as a control measure is of little value, although it will help in securing good growth of the seedlings at the start. Subsequent fungicidal treatments with Bordeaux mixture are therefore necessary while the plants are in the seedbed and in the field. A number of disinfectants have been recommended for treating seeds to eradicate the late blight disease from them. Klebahn(23) suggests twenty-four hours immersion in copper sulphate (20 grams in 1 liter of water), followed by washing in water with or without lime. Schenk(38) recommends soaking the seeds in 1 : 1000 corrosive sublimate for half an hour after presoaking for the same period, or in 20 per cent hydrogen peroxide for three hours. Flachs(17) and Muller(29) suggest seed treatments with germisan and uspulun. Hot water treatment, thirty minutes at 48° C., has been successfully adopted in certain places in the United States. In this connection Krout(26) states that the spores of Septoria are killed in 30 minutes at 40° C., the mycelium at 45° C. and the seed is not apparently injured below 50° C. but vitally destroyed between 50° and 55° C.

Seedbed disinfection.—Since infection usually starts from the seedbed, it is necessary to disinfect the seedbeds with formalin and organic mercury compounds without impairing the germinability of seeds. Klebahn(23) suggests disinfection of seedbeds with a solution of 0.5 liter of commercial formalin in 12 liters of water per two square meters of surface. Flachs(17) recommends the use of 0.5 per cent solution of uspulun or germisan. These different chemicals should therefore be tried in seedbeds known to be infected with late blight.

2. AGING THE SEEDS

The pathogene is known to lose its vitality after two or three years in the infected seeds and the seed still shows high percentage of germination. According to Krout(26) the spores and mycelium of the parasite from the pycnidia in the peduncles and pericarp of celery seed gave from 2 to 3 per cent germination at the end of two to three years and the seed three to four years old gave a good germination test. Therefore aging infected seeds for at least two years will eliminate the fungus in the seeds.

3. SPRAYING AND DUSTING WITH COPPER FUNGICIDES

The use of copper fungicides has been recommended as very effective in controlling celery late blight. According to Chupp

(8) Coons, Nelson and Walker(10), Durrel and LeClerg(14), and Ogilvie(30) spraying with 5–5–50 Bordeaux mixture or dusting with 20–80 copper-lime dust can control this disease. The first two applications of the spray or the dust are given when the seedlings in the seedbeds are about an inch high, and again a few days before they are transplanted. When the plants are pretty well started in the field, spraying or dusting is continued at weekly or 10-day intervals until a week or two before harvest. Usually five or six applications of the spray or the dust are necessary during the growing period of the plants in the field. Rogers(37) states that spraying with 5–6–50 Bordeaux mixture proved satisfactory in controlling the late blight Septoria while Foster and Weber(18) recommend weekly applications of the 4–4–50 formula. Spraying four to five times with 2 per cent Burgundy mixture (8 pounds copper sulphate, 10 pounds washing soda, and 40 gals. water) was claimed to have controlled the disease in Ireland (1). Ogilvie(31) recommends the use of Burgundy mixture as a substitute for Bordeaux mixture in late spraying of celery since it does not discolor the plants so badly. The results of spraying trials in Trinidad Valley have shown that 5–5–50 Bordeaux mixture applied every ten to fourteen days control the disease, while 4–4–50 applied every week gave satisfactory results. Because of the discoloration of leaves due to Bordeaux mixture, Burgundy mixture suggested by other authors should be used, a week or so before the plants are harvested.

THE EARLY BLIGHT DISEASE

HISTORY, HOSTS, AND GEOGRAPHIC DISTRIBUTION

The early blight of celery was first reported in 1863 by Fresenius.(19) It was first observed in the United States by Galloway(20) in 1881. Available reports indicate that this disease is common in Europe and America (2, 24, 25, 42) and it is also found on celery in Tanganyika, East Africa,(44) India,(2) Bermuda,(30) southern China,(36) and the Philippines,(35) and on parsnip (*Pastinaca sativa* L.) in South Australia.(31) Aside from celery and parsnip it has been mentioned to attack celeriæ (*Apium graveolens* L. var *rapaceum* D. C.), carrot (*Daucus carota* L.), wild parsnip, and parsley (*Carum petroselinum* B. and H.).(8, 13, 24, 42)

Although the early blight is widely distributed, it is not considered a serious disease of celery in certain places. While in the United States it occasioned great losses in California and

Florida,(24) it has not much attracted the attention of celery growers in Europe, probably because it did not cause damage there.

In the Philippines, the green celery grown by Chinese gardeners in Manila and the celery grown at the experimental plots in Lipa, Batangas, are found badly affected by early blight. The origin of the disease is not definitely known. Perhaps it was introduced into this country with the early importation of celery seeds. Th disease is common in the gardens around Manila, causing from 10 to 100 per cent infection. Because of stripping of infected stems and leaves, the loss due to the disease is estimated at from 8 to 10 per cent of the crop. It may be found at any time of the year, although it evidently damages the crop more during the summer months. It attacks the plant in all its stages of development, but usually the infection during the seedling stage is not as serious as when the crop reaches marketable age.

SYMPTOMS

The disease on the leaf is characterized first as light yellow-green, circular spots a millimeter or less in diameter, enlarging in all directions into subcircular, tawny olive spots bordered by buffy-olive tissue (Plate 1, fig. 2). When obstructed by the veins or when they develop along the edge of the leaflets, the spots become irregular in shape. The old spots measure from 5 to 10 millimeters, develop ashen gray centers with papery texture, and are more or less confluent. They are found on any part of the leaflet and not infrequently along the serrations. The olivaceous coloration of the spots is due to the abundance of fruiting structures of the causal fungus. Severely affected leaves curl inward and dry up later.

On the petioles the spots appear as long narrow light brown streaks, gradually turning tawny olive, often extending for 20 or more millimeters along the petiole. Olivaceous fruiting structures develop on the sunken areas of the streaks.

Plants seriously attacked by the disease during their early stage become stunted (Plate 2) and may die before reaching marketable size.

CAUSAL ORGANISM

The disease is caused by *Cercospora apii* Fresenius. The mycelium is internal, hyaline or subhyaline; the hyphæ vary from 1.5 to 3.8 μ in diameter. The conidiophores (Plate 3, figs. 4 and 5) are amphigenous, arising from a stroma of more or

less compactly woven cells 3.0 to 6.8 μ in diameter. They are produced singly or in tufts of 2 to 12 at stomatal openings or at any points on the leaf surface. Usually the upper half portions of the conidiophores are lighter in color than the lower half, which is generally olive brown. They measure from 30.0 to 144.0 μ in length and from 3.0 to 5.8 μ in diameter, and are 0- to 2-septate. The conidial scars are found along the sides or on the tip of the conidiophore. The conidia are straight or slightly curved near the tip, "acicular obclavate," hyaline or slightly tinged with green (Plate 3, fig. 3). They measure from 19.0 to 122.0 μ in diameter at the widest point, and are from 1- to 20-septate.

The lengths of conidiophores and conidia are greatly influenced by moisture, but their diameters are slightly affected. The conidiophores and conidia from lesions which were kept in the moist chamber for 24 hours were found longer than those obtained on fresh collection from the field. The conidiophores after 24 hours in moist chamber measure from 34.0 to 163.0 μ in length and from 3.3 to 5.8 μ in diameter, and are generally 1- to 4-septate (Plate 3, fig. 6). The conidia on the other hand measure from 23.0 to 182.0 μ in length and from 2.5 to 5.0 μ in diameter, and are from 1- to 22-septate. On the average the conidiophores and conidia are respectively 40.0 μ and 11.7 μ longer than those obtained from lesions freshly collected from the field. The variation in the sizes of conidia or conidiophore, therefore, is influenced by environmental factors as observed by Duggar(13) and Solheim.(40)

THE RELATION OF TEMPERATURE TO DEVELOPMENT OF EARLY BLIGHT

The early blight is usually favored by a warm climate. Galloway(20) reports that it does greater damage in regions where summers are long, hot and dry. Klotz(24) found that the fungus is favored by high temperatures, from 26° to 32° C. and produces the best growth between 25° and 30° C.

In the Philippines the early blight is thus far found only in the Chinese gardens in Manila all the year round and has not yet been observed in Baguio and at higher altitudes. In Manila, the temperature is relatively warm with monthly temperatures ranging from 19.4° to 34.9° C, the monthly mean varying from 23.7° to 28° C. In figure 1 it will be seen that the temperature in Manila is more favorable for the development of the fungus, and this perhaps explains why the disease has not been found in Baguio where the temperature is relatively cooler.

CONTROL OF EARLY BLIGHT

Bordeaux mixture has been generally accepted as the best fungicide to use for the control of early blight. The spray strength recommended is 5–5–50 and 4–4–50. The applications for the control of late blight with this spray should follow in all their details those for the control of late blight.

SUMMARY

1. Late blight and early blight are the two most destructive fungous diseases of celery in the Philippines. Late blight is found only in the Mountain Province, where the climate is semitemperate, while early blight is present only in and near Manila where the weather is much warmer.

2. These two diseases are widely distributed in Europe and America, and are probably present in all countries where celery is extensively grown.

3. The losses due to these two diseases in the Philippines have been placed at from 10 to 20 per cent of the crop for late blight and from 8 to 10 per cent for early blight. Under favorable condition these diseases may cause total loss of the crop.

4. Late blight on celery leaves is characterized by the production of numerous small, circular or irregular brown lesions which subsequently merge and develop numerous, minute, rusty-brown pustules or fruiting bodies. Sunken linear lesions are produced on the stalks. The distinguishing characteristic of early blight is the production of large, subcircular, tawny-olive spots with ashen gray centers upon which mouldy growths consisting of the fruiting structures of the causal fungus develop during moist weather.

5. The fungus causing late blight of celery in the Philippines is identical with *Septoria apii-graveolentis* Dor. and that causing early blight is no doubt *Cercospora apii* Fres.

6. The temperature range of Baguio and of Manila has been found to be nearly the same as the temperature range found by various authors for the development of late blight and early blight respectively.

7. Both late blight and early blight can be controlled by Bordeaux mixture. In Trinidad Valley, Mountain Province, satisfactory results were obtained by spraying celery with 5–5–50 Bordeaux mixture at 10 to 14 days intervals and with the 4–4–50 formula at weekly intervals.

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ILLUSTRATIONS

Plate 1

Fig. 1. A celery leaf badly attacked by late blight. The diseased areas on the leaf are heavily studded by rusty-brown pustules or pycnidia of the causal fungus. More than natural size.

2. A leaf of green celery ("Kinchay") showing early blight spots with ashen gray centers. More than natural size.

Plate 2

Fig. 1. Late blight on celery plants collected in Trinidad Valley, Mountain Province. Note the stunted appearance of the plant and the serious blighting of the outer leaves. About 1/3 natural size.

2. A healthy plant. About 1/3 natural size.

3. A green celery plant severely attacked by early blight. Note the dead leaves and the stunted appearance of the plant. Nearly natural size.

Plate 3

Fig. 1. *Septoria apii-graveolentis* Dor. A section through the pycnidium obtained from the lesion on the stalk of celery. Note the myriads of spores produced in the pycnidium × 380.

2. Spores of *Septoria apii-graveolentis.* × 1673.

3. Spores of *Cercospora apii* Fres. × 800.

4. A fascicle of conidiophores of *Cercospora apii* from freshly-collected diseased leaves.

5. A fascicle of conidiophores of *Cercospora apii* obtained from lesions on leaves which were confined for 24 hours in a petri dish without the addition of moisture. × 800.

6. A fascicle of conidiophores of *Cercospora apii* obtained from lesion on a leaf which was placed in moist chamber for 24 hours. ×800.

Text figure

Fig. 1. Graphs showing the average monthly humidity and mean temperature for Baguio and Manila in 1932. Prepared from Philippine Weather Bureau Meteorological data.

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PLATE 1.

1 2

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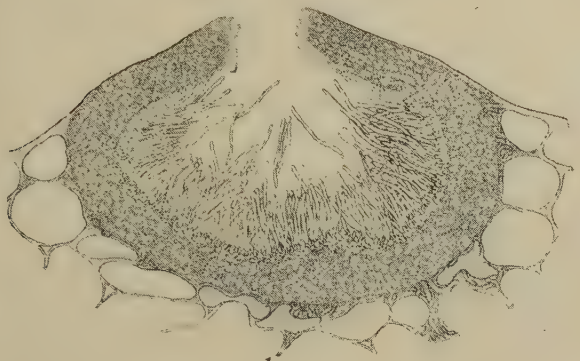
PLATE 2.



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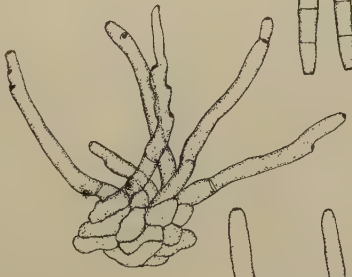

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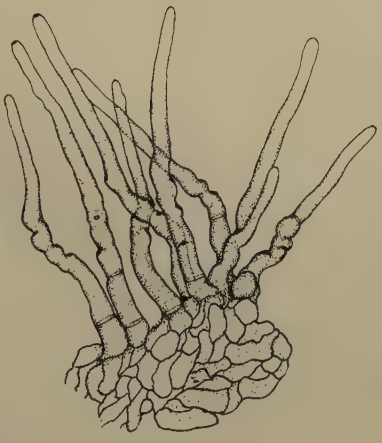

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PLATE 3

PEANUTS IN THE PHILIPPINES

By JUAN M. EJERCITO

Of the Bureau of Plant Industry, Manila

FOUR PLATES AND TWO TEXT FIGURES

The cultivation of the peanut in the Philippines dates back to its first introduction from tropical America during the early days of Spanish colonization. Perhaps not until about 1914, however, has it attained commercial importance as a money crop in the Islands. Peanuts and peanut oil were imported into the Philippines as early as 1911 to the amount of 842,535 kilograms of nuts, valued at ₱102,138, and 518,341 liters of oil, valued at ₱125,832, or a total of ₱227,970. The bulk of the import comes from neighboring China and Japan. The Philippines should be at least self-sufficient, if not an exporting, country of this commodity, the importation of which has been increasing from year to year. From 1921 to 1932 the total import amounted to ₱9,207,113, or a yearly average of about ₱767,259. Being a tropical crop, the peanut is well adapted to Philippine conditions. Its wide adaptability, ease of cultivation, varied uses, and big demand locally and abroad, particularly in the United States where the Philippine peanut is admitted free of duty, should cause it to be grown extensively in the Islands.

VARIED USES

The importance of the peanut, both as human food and as a feed for animals, is becoming generally recognized. It is claimed that the peanut contains complete protein, that is, all the essential elements needed for building up the different tissues of the body. The Bureau of Science found that a kilogram of whole peanut, as used in confections, peanut butter, etc., contains one-fourth kilogram of protein, and nearly one-half kilogram of fat, both the protein and the oil (or fat) being of a very high grade and readily digestible. Peanut is also claimed to be the cheapest meat substitute in a vegetarian diet. Its oil is used in packing sardines, for medical emulsion and as a substitute for olive oil, and adulterant of cotton oil, and an ingredient of margarine.

The lower grades are utilized for soap and cosmetics. The roasted nuts are combined with cacao in the manufacture of chocolate.

As human food it is eaten from the shell either roasted or boiled, and shelled as candied peanut, peanut butter, and in various confections. The peanut oil is sometimes used for shortening. The properly dried stems and leaves as hay constitute a very nutritive feed for animals.

ADAPTATION AND DISTRIBUTION

Peanut thrives at practically all elevations and under a wide range of soil and climatic conditions in the Philippines. Except Batanes, all provinces produce peanuts (See table 1). Ilocos Norte (with a first type of climate), yields the greatest, followed by Pangasinan (with a first type of climate), Leyte (with a second type), Cebu (with an intermediate B–type of climate) and Cagayan (with an intermediate A-type of climate).

TABLE 1.—*Production of peanuts in the Philippines for the year ended June 30, 1932.*

Province.	Production.	
	Kg.	*Per cent.*
1. Abra	38,540	0.85
2. Agusan	3,850	0.08
3. Albay	133,800	2.95
4. Antique	22,910	0.07
5. Bataan	118,250	2.63
6. Batanes		
7. Batangas	192,100	4.26
8. Bohol	139,400	3.08
9. Bukidnon	8,410	0.19
10. Bulacan	48,150	1.07
11. Cagayan	214,160	4.75
12. Camarines Norte	5,640	0.64
13. Camarines Sur	200,180	4.67
14. Capiz	36,000	0.80
15. Cavite	75,910	1.69
16. Cebu	245,040	5.41
17. Cotabato	10,980	0.24
18. Davao	12,300	0.27
19. Ilocos Norte	674,840	14.96
20. Ilocos Sur	148,500	3.29
21. Iloilo	180,140	3.99
22. Isabela	155,940	3.45
23. Laguna	3,590	0.08
24. Lanao	130,230	2.88
25. La Union	89,100	1.97
26. Leyte	261,940	5.78
27. Marinduque	12,180	0.27

TABLE 1.—*Production of peanuts in the Philippines for the year ended June 30, 1932*—Continued

Province.	Production.	
	Kg.	*Per cent.*
28. Masbate	18,940	0.42
29. Mindoro	4,510	0.01
30. Mountain	10,310	0.13
31. Nueva Ecija	190,900	4.23
32. Nueva Vizcaya	32,600	0.72
33. Occidental Misamis	18,500	0.42
34. Oriental Misamis	10,500	0.23
35. Occidental Negros	56,950	1.26
36. Oriental Negros	42,500	0.94
37. Palawan	1,590	0.02
38. Pampanga	79,680	1.76
39. Pangasinan	575,100	12.75
40. Rizal	9,500	0.21
41. Romblon	1,200	0.03
42. Samar	29,120	0.65
43. Sorsogon	9,140	0.21
44. Sulu	87,840	1.94
45. Surigao	5,680	0.12
46. Tarlac	60,120	1.33
47. Tayabas	23,800	0.52
48. Zambales	4,500	0.10
49. Zamboanga	75,640	1.68
Total	4,510,700	100.00

PRODUCTION, EXPORT, AND IMPORT

The following data are based on the 1932 report of the Bureau of Customs and of the Statistics Division of the Department of Agriculture and Commerce:

	Kg.	Pesos.
Total imports of nuts	1,950,305	193,242
Total imports of oil	2,611,799	399,607
Quantity of nuts required to produce the imported oil based on 50 per cent oil content	5,223,598	
Total import in terms of nuts	7,173,903	592,849
Total Philippine production	3,202,597	
Total Philippine export	7,684	
Consumption of local produce	3,194,913	
Total consumption	10,368,816	
Total area cultivated in the Philippines (hectares)	7,750	
Area necessary to cultivate to produce the additional amount imported (hectares)	17,370	
Total area to be cultivated to cover the total consumption (hectares)	25,120	

The above data indicate that the total Philippine production in 1932 was only three-tenths of the total consumption. To cover this importation the cultivation of 17,370 additional hectares is necessary.

There is no danger of overproduction. The United States is a great importing country of this commodity, and will offer a ready market for any surplus production in the Islands. Table 2 shows the importation of peanut and peanut oil into the United States:

TABLE 2.—*Importation of peanuts into the United States.*

[From the Statistical Abstract of the United States. United States Department of Commerce. Bureau of Foreign and Domestic Commerce.]

Year.	Not shelled.		Shelled.		Oil.	
	lbs.	*Dollars.*	*lbs.*	*Dollars.*	*lbs.*	*Dollars.*
1921	4,523,841	202,840	35,640,992	1,521,924	3,020,509	314,353
1922	3,115,297	137,300	8,850,992	384,061	2,469,938	281,492
1923	3,938,026	174,227	48,364,137	2,294,359	8,008,622	759,904
1924	4,951,843	206,219	55,975,573	2,468,439	15,394,836	1,325,538
1925	10,456,957	506,504	73,134,105	3,691,783	3,026,950	387,172
Total	26,985,964	1,227,090	221,965,799	10,360,546	31,920,855	3,068,459
Average	5,397,192	245,418	44,393,159	2,072,109	6,384,171	615,691
1926	3,989,935	190,054	42,589,602	1,984,154	8,281,264	865,785
1927	4,490,000	179,000	38,805,000	1,651,000	2,847,000	340,000
1928	13,739,000	591,000	55,862,000	3,065,000	4,749,000	520,000
1929	4,609,000	194,000	26,631,000	1,272,000	3,231,000	333,000
1930	3,218,000	107,000	4,258,000	162,000	15,565,000	949,000
Total	30,045,930	1,261,054	168,145,602	8,134,154	34,473,264	3,007,785
Average	6,009,187	252,210	33,629,120	1,626,830	6,934,652	601,557
1931	4,277,000	115,000	6,229,000	191,000	14,886,000	645,000
1932	473,000	10,000	59,000	2,000	1,489,000	90,000

VARIETIES

There are now many varieties of the peanut in the Philippines. Their high number may be accounted for by the different names given to the same variety in different localities, the isolation of new strains and hybrids, and the introduction of foreign varieties.

Peanuts are classified according to their mode of growth into two types: The runner type has a creeping habit; it forms pods along the lateral stems that touch the ground. The bunchy type grows erect and forms pods in clusters around the base of the tap root.

Again peanuts are classified in the market according to the size of the kernels. The large-kerneled varieties like the Jumbo,

Virginia Runner, and Chinese, are preferred for confections. The small-kerneled varieties, as Spanish, San Mateo, Vigan Lupog, and Zambales, are preferred for oil extraction. For hay purposes the Spanish and similar varieties are recommended because of their erect growth and thin leaves which do not touch the ground like those of the runner varieties. The vegetation can easily be cut and cured.

DESCRIPTION OF VARIETIES

1. The Spanish variety introduced from Spain is most widely grown in the Philippines. The pods are small with an average length of 3.2 centimeters. The longitudinal ridges are rather prominent and sharp, and the rugae are quite marked. They usually contain two kernels of light brown color. The shell is fairly thick. The vines with rather heavy foliage grow erect and the pods form in clusters around the base of the plant. Matures in from 105 to 125 days. When allowed to overmature in the field, this variety germinates readily.

2. The San Mateo is a locally grown variety similar to the Spanish. It belongs to the bunchy type. The pods are small and usually contain two to three light brown kernels. Matures in from 105 to 125 days.

3. The Zambales variety is widely grown in Zambales Province. It is a bunchy type with the pods formed in clusters around the base of the tap-root. The pods are smaller than those of the Spanish. The shell is thin. It usually contains two red kernels. The shelling percentage is as high as 78 per cent. Matures in from 105 to 125 days.

4. The San Jose No. 3 is another locally grown peanut in San Jose, Nueva Ecija. It is similar to the Spanish and belongs to the bunchy type. The pods are small and contain generally two light brown kernels. The shell is fairly thin. Matures in from 105 to 125 days.

5. The Virginia Jumbo is an introduced variety from the United States. The pods are formed along the lateral stems. They are big with blunt-edged longitudinal ridges and rugae not so distinct. There are usually two reddish brown kernels in a pod. Matures in from 165 to 185 days.

6. Valencia is an American variety. It has a vigorous and upright growth. The pods are clustered around the base of the plant. They are usually slender and from 3.3 to 5.2 centimeters long. The longitudinal ridges are less prominent and the rugae are not so deep. The shell is rather thin. There are

usually two to three dark-red kernels (1.4 centimeters long). Matures in from 165 to 185 days.

7. Kinorales is a native variety of the bunchy type. The pods and kernels are smaller than those of the Spanish. There are usually two bright red kernels in a pod. The shell is thin. Matures in from 105 to 125 days.

8. The Tennessee Red is an introduced variety from the United States. It has a vigorous upright growth with the pods formed at the base of the plant. The pods are long and slender with three to four kernels of bright red color. The shell is thin. This variety is popularly used for roasting. Matures in from 105 to 125 days.

9. Vigan Lupog is another local variety in Vigan, Ilocos Sur. It is very similar to the Spanish. The pods are small and contain usually from two to three kernels of a light brown color. Matures in from 105 to 125 days.

10. Virginia Runner has a spreading habit of growth. The pods are formed at the base and along the lateral stems that creep along the ground, hence runner. They usually contain two reddish-brown kernels which are somewhat smaller than the Valencia. This variety is rather hard to cultivate and to harvest. Matures in from 165 to 185 days.

11. Virginia bunch has pods very similar to Virginia runner. They are formed at the base of the plant. There are usually two reddish brown kernels in a pod. This variety is easy to cultivate and to harvest. Matures in from 165 to 185 days.

12. Georgia Red. Well cleaned and dried pods are creamy white. The longitudinal ridges and rugae are not very distinct. Usually two red kernels in a pod. The kernels are a little larger than the Valencia (1.8 centimeters average length). Bunchy type.

13. Cagayan No. 1. Pods are small with prominent longitudinal ridges and distinct rugae. The shell is fairly thick. Usually there are two light brown kernels in a pod. This is a bunchy type.

14. Macapno. This is a bunchy type. The plants are vigorous. Pods quite small (2.5 centimeters average length) with fairly distinct rugae and sharp longitudinal ridges. The divisions between the kernels appear distinctly outside in most cases. The shell is quite thin. There are two kernels of light brown color in a pod, which usually tightly fill the pod, hence "macapno." Matures early in from 105 to 115 days under Alabang condition.

CLIMATIC REQUIREMENTS

The peanut thrives well under a wide range of climate in the Philippines. It grows from sea level up to 4,800 feet. For commercial planting it should be grown from sea level up to 500 feet. It needs a warm climate with abundant sunshine and moderate rainfall throughout its growing period. High yields are obtained where the annual rainfall is from 42 to 54 inches, all other conditions being the same. Places subject to drought may be planted successfully to the peanut if irrigation water is available. Too much rain is not conducive to the proper development of the plant.

SOIL REQUIREMENTS

The peanut adapts itself to a wide range of soil types. For its commercial production the best soil is a fairly deep, well-drained and light sandy loam soil containing sufficient available nitrogen, phosphorus and potash. A liberal supply of lime and humus is also desirable for the proper development of pods. For feed purposes peanut may be grown on any kind of soil. It is claimed that high yield is obtained on dark loamy soil, but there the pods are stained by the dark color of the soil. Dark nuts are not in such high demand in the market as the light-colored ones.

Hard stiff clay soils should be avoided because the pegs bearing the would-be-pods will hardly penetrate the soil and properly develop upon reaching it.

PEANUT SEED

CARE

Vibar and Rodrigo (1924) found that peanut seeds lose their vitality in 14 to 16 months after harvest in the Philippines. For seed purposes peanuts should be harvested when properly matured. The newly harvested pods attached to the plant should be cured properly in 4 to 6 weeks, depending upon the weather. (See Curing.) The warmer the days, the shorter the curing period. The aim in curing is to minimize the production of too much shriveled seed and to ripen gradually the imperfectly matured pods. Molding and souring are also avoided.

Seeds for planting should be carefully dug when fully matured, preferably during bright weather, and properly cured before storage. Curing is not commonly practiced in the Islands. All light and inferior pods as well as any other foreign material should be removed. Care should be taken not to break or injure

the thin skin of the kernels as it will lower the power of germination. If necessary the pods should be treated with some kind of disinfectant, as formalin (about 10 minutes immersion in 2 per cent to 3 per cent formalin), mercuric chloride solution (1 to 1000 parts) and sulphur dust.

SELECTION

One way of peanut improvement is by seed selection according to the ideals the planter has in mind. If high yield is desired, the seeds for planting should be selected among the vigorous high yielding individuals with the greatest number of sound and matured pods. If three-kerneled pods are desired, seeds from pods with this characteristic should be selected and planted.

These selected seeds can be cultivated in small patches or plots about four meters long and two meters wide. The selection and planting of these seeds should be repeated for a number of years, until the ideals aimed at are attained. Proper care should be taken not to mix the selected seeds with the undesirable ones.

FERTILIZERS

The application of fertilizers to peanut fields is not a common practice in the Philippines, probably because the land cultivated to this crop is generally of the rich alluvial or sandy loam type. Moreover, peanuts are not grown continuously for a number of years on the same field.

Being a leguminous plant, the peanut is more of a renovator than an exhaustive crop. It has the power of acquiring the free nitrogen of the air and to convert it into nitrate form through the agency of the micro-organisms residing in its nodules. The peanut becomes an exhaustive crop only when the root-bearing nodules are entirely removed from the field. This generally happens, because at harvest time the entire plant is pulled up and the leaves are utilized for forage.

Wood ash.—Consunji (1916) found that the application of wood ash increased the yield in weight of pods by 7.3 per cent for the American variety, 36.7 per cent for the Calcutta, and 16.9 per cent for the Spanish C. A. With stable manure the increase for the American variety was 38.1 per cent.

Silayan (1917) found that fertilization with ash gave an increased yield in oil content of 4.19 per cent for the Big Japan and 4.91 per cent for the American variety.

Complete fertilizer.—The Virginia Agricultural Experiment Station Bulletin 229 recommends for thin sandy soils the application of a complete fertilizer analyzing 2 per cent nitrogen, 8 per cent phosphoric acid, and 4 per cent potash, with all the nitrogen from an organic source. The rate of application varies from 300 to 500 pounds per acre, depending upon the fertility of the soil. On heavy fertile soils from 300 to 500 pounds of acid phosphate to hasten maturity is recommended.

Fertilizers are applied preferably three or four days in advance of the planting time, so they may become well mixed with the soil. They should be applied directly in the row, although precautions should always be taken to mix the fertilizers thoroughly, so that lump particles will not come in contact with the seed.

Lime.—Lime gives an improving effect on the quality of the peanut. The pods are usually better filled, the shells are whiter and have greater weight per bushel or per kilogram.

Results of lime application test carried on at the Pee Dee Experiment Station for three years (1917 to 1919, inclusive) indicate that lime had no marked effect on the yield of peanut. But this does not mean that additional lime is not always needed by the soil grown to peanut. Acidic soils which require lime show a marked effect on the quality and possibly on the yield of the crop.

PREPARATION OF THE SOIL

The soil should be in good tilth before planting. The ground should be plowed at least twelve inches deep at the start of the rainy season for the wet season culture and at the beginning of the dry season for the dry season culture. Plowing for at least three times in alternation with harrowing may be sufficient to put the soil in good tilth. Sufficient time of at least a day or two should be allowed between the interval of each operation to put the soil in such a condition that it can easily be pulverized. In the course of these operations, all stubbles, weeds, and obstruction of all kinds should be removed. The field should be kept as nearly level as possible.

SEEDAGE PER HECTARE

The amount of seeds required to plant a hectare depends upon the size of the seed or variety. About 30 kilograms of shelled Spanish variety or about 40 kilograms of the unshelled seed are required to plant a hectare. With the larger varieties about

26 kilograms of the shelled seed are sufficient to plant a hectare as they are planted farther apart than the small seeded or bunchy varieties.

PLANTING

The peanut may be propagated either shelled, in pods, or by cuttings. Kernels or shelled nuts are most widely planted, as they are economical, easy to handle, germinate early, and good seeds can readily be selected. One objection, however, is that the kernels are often eaten by ants in the field. Propagation by cuttings and in pods are not practised. Rodrigo (1929) found that stem cuttings from three-month-old plants gave the highest rooting percentage of 71. But those from the two-month-old plants yielded the highest of 10.1 ± 0.37 grams of pods per plant. Two to three stem cuttings may be obtained from a plant. With this method seeds for planting may be saved.

METHODS

The most widely used method is to plant kernels in furrrows, irrespective of the season. But unpublished results obtained by Vibar and Rodrigo on their three year test at the College of Agriculture, Los Baños, with the different varieties of the peanut, have shown that the plantings in ridges gave a decidedly higher yield of 15.3 per cent in favor of the ridge (see table 3).

From the summary table it can be seen that the ridge culture gave a higher mean yield of nuts and straw per plant than the flat culture.

TABLE 3.—*Effect of ridge and flat methods of culture on the production of peanut (1926–27).*

FIRST CULTURE

Variety.	Ridge culture.		Flat culture.	
	Nuts per hill.	Straw per hill.	Nuts per hill.	Straw per hill.
	g.	*g.*	*g.*	*g.*
1. Javanese	62.10±2.06	200.80± 5.11	50.50±1.44	142.40±4.29
2. Lemery	90.90±1.90	295.20± 6.10	77.40±1.96	242.80±7.03
3. Spanish	61.00±1.37	152.20± 3.27	55.50±1.50	135.00±3.63
4. Vigan Lupog	82.40±2.15	376.40±10.81	66.90±2.04	204.00±6.59
5. Zambales	37.60±1.38		55.30±1.99	
6. Valencia	63.10±2.41		54.80±1.99	
7. American	41.70±1.55		36.40±1.39	

TABLE 3.—*Effect of ridge and flat methods of culture on the production of peanut (1926–27)*—Continued

SECOND CULTURE

Variety.	Ridge culture.		Flat culture.	
	Nuts per hill.	Straw per hill.	Nuts per hill.	Straw per hill.
	g.	*g.*	*g.*	*g.*
1. Javanese	38.90±1.03	98.80±3.05	32.80±1.01	83.20±2.82
2. Lemery	57.50±1.31	131.40±3.66	48.40±1.14	100.80±3.47
3. Spanish	41.60±1.22	143.20±4.00	34.20±1.07	135.00±3.87
4. Vigan Lupog	62.70±1.72	228.00±6.37	50.40±1.40	164.00±5.48
5. Zambales	67.10±1.43	174.80±4.02	40.89±0.98	113.54±2.81
6. Valencia	38.15±0.94	76.80±2.68	25.15±0.76	58.20±1.94
7. Kinorales	35.90±1.32	123.00±3.69	53.60±1.29	111.00±3.15

THIRD CULTURE

1. Lemery	66.10±1.53	91.80±2.19	55.30±0.53	84.00±2.12
2. Vigan Lupog	27.90±1.11		30.30±1.57	
3. Zambales	66.40±1.52		67.10±1.83	
4. Valencia	49.80±1.20		36.10±1.29	
5. Kinorales	70.70±1.67	81.60±2.19	55.30±0.53	88.20±2.48

SUMMARY

1. Javanese	55.10±1.54	149.8 ±4.08	41.60±1.22	112.80±3.55
2. Lemery	71.50±1.58	141.3 ±3.65	60.30±1.21	142.50±4.30
3. Spanish	51.30±1.29	147.7 ±3.63	44.80±1.28	135.00±3.75
4. Vigan Lupog	57.60±1.66	228.00±6.37	49.20±1.67	184.00±6.03
5. Zambales	57.00±1.44	174.8 ±4.02	54.40±1.60	113.50±2.81
6. Valencia	49.80±1.51	76.8 ±2.68	38.60±1.34	58.20±1.94
7. Kinorales	63.30±1.49	102.3 ±2.94	54.40±0.91	99.60±2.81
Average	57.90±1.50	145.8 ±3.91	49.00±1.31	120.80±3.59

DISTANCE OF PLANTING

The distance of planting varies with the variety and the soil fertility. The bunchy type is commonly set at a distance of 65 centimeters between rows and 35 centimeters between hills in the row. The runner type is generally spaced at 80 by 50 centimeters. Three seeds are generally dropped in a hill, preferably in the form of a triangle to provide space between them. They are covered with fine soil at a depth of 3 to 8 inches. They are set deeper during the dry season so that they may have enough soil moisture for their early germination. Disinfected seeds repel insects that eat them and are therefore preferable for planting. During the dry season it is preferable to soak the

seeds in water overnight before planting to hasten germination.

Experience has shown that it is never advisable to plant the newly harvested seeds, because in most cases many rot owing perhaps to the presence of much moisture in them and to their dormant state. Seeds for planting should be seasoned, that is, seeds harvested in the dry season should be planted the next dry season, and those obtained from the rainy season culture should be planted the next rainy season.

TIME TO PLANT

The peanut is planted practically at the same time as corn. Two crops are easily raised a year, one during the rainy season and the other during the dry season. The rainy season culture is generally planted in May or early June and harvested in August or September. The dry season culture starts in November or early December, and is harvested in January or February. Plantings later than June generally catch too much rain, and no sufficient amount of cultivation could be given to the crop as the soil is always wet. Consequently the field becomes very weedy. Late dry season planting has its objections also in that the crop catches drought and its proper development is arrested due to lack of sufficient moisture. The extreme heat bakes the soil.

CULTIVATION AND CARE OF THE CROP

Cultivation with the plow should be started during good weather as soon as the plants have about four or five leaves, and repeated as often as necessary until the vines have spread sufficiently to cover the greater portion of the ground. When the soil becomes compact after heavy rains, the surface should be stirred as soon as it is reasonably dry. This will form a dust mulch to check too much evaporation of the soil moisture. At the Lamao Horticultural Station, Bataan, cultivation with the use of a five-tooth cultivator is practiced. This is done about a week before the plants are up, and followed by plowing to cover up the base of the plants.

SPECIAL CULTURAL PRACTICES

In the United States, after the final cultivation, a light roller is run over the plants to flatten the stems upon the ground and to enable the pegs bearing the would-be-pods to reach the soil. This practice is followed only with the runner varieties, and tends to cause the greatest number of pods to mature almost

at the same time. It is not followed with the erect type, as the plants may be seriously damaged. This method is not yet in vogue in the Philippines.

CROP ROTATION

The peanut should not be grown in the same place of land oftener than once in two or three years. It should be rotated with legumes such as cowpea and mungo; corn, tobacco, cotton, and other cover crops, as *Centrosoma, Indigofera, Calopogonium,* etc. Rotation will partly check the occurrence of pests and diseases, will povide a mellow soil, and prevent the exhaustion of one kind of plant food element in the soil.

Rotation may be practiced by dividing the field into parcels and planting each parcel to different crops at different periods of time. The crop planted to each parcel should be interchanged with those planted in the other parcels alternately.

HARVESTING

TIME TO HARVEST

The proper time to harvest is just as important as any other field operation in the growing of the peanut, because some varieties, like the Spanish, germinate readily or rot if allowed to overmature in the field. Defoliation follows, and part of the value of the forage will be lost. The signs of maturity are the following:

1. Slight yellowing of the foliage (not due to disease or pest).
2. Darkening of the veins inside the shell.
3. The usual maturing period which is from 105 to 125 days in most of the bunchy varieties and 165 to 185 days in most of the runner varieties.

Harvesting should be done preferably during bright weather and when the soil is not too wet. One great objection with the rainy season culture is the frequent coincidence of the harvesting time with the rainy days. Pending more suitable weather, the pods become overmature and many rot or germinate. The Spanish variety possesses this characteristic. The drying also of the newly harvested pods is difficult.

CURING

Curing is not commonly practiced in the Islands. The usual method is to pick the pods immediately after the harvest and to dry them thoroughly in the sun. This results in the production of many shriveled kernels. At the Alabang Rice Station, Rizal, it was observed that after five months' curing, no shriv-

eled kernels were produced. The imperfectly ripe pods gradually matured and the pods were thoroughly dry.

METHOD

The proper way to cure the peanut is as follows: After the plants are dug up, they are shaken to remove the adhering soil particles on the pods, and spread on the ground for exposure to the sun for a few hours to slightly wilt the vines. They are then placed in small stacks around poles to which two crosspieces have been nailed at right angles to each other, 8 to 12 inches from the ground (fig. 1).

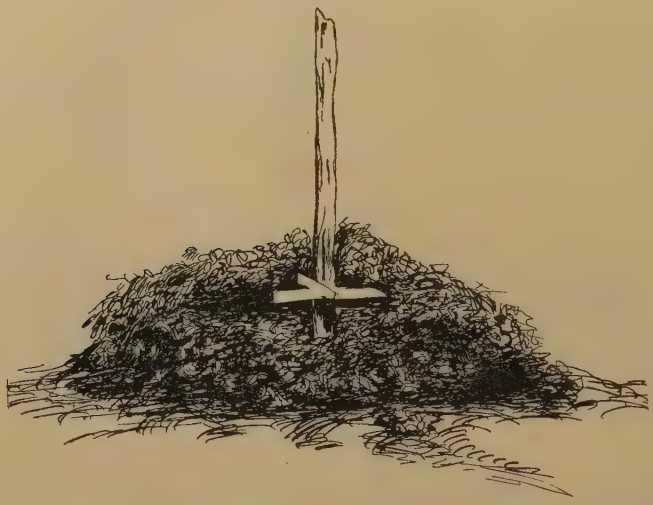

FIG. 1. Pole around which peanuts are to be stacked.

The poles are about 7 feet long and 3 to 4 inches in diameter at the base, and sharpened at both ends. The crosspieces are 14 to 18 inches long. These poles may be made of any sufficiently strong materials available in the locality. In the Philippines bamboo may be used.

The vines are assembled around the stacking poles with forks having six or eight tines, and arranged in circles with the roots toward the pole at a sufficient distance around so that the person stacking can work comfortably. At the start a few vines are hung on the crosspieces to form a foundation. The vines are continuously piled around the pole by hand and are occasionally pressed down. The peanuts are kept in the center next to the pole. The stacks should not be more than 1½ to 3 feet in height

in order to provide ventilation and avoid souring. When completed, the stack will have its center a little raised up. The top is capped with some weeds or straw as protection from rain (fig. 2). Normal curing lasts from 4 to 6 weeks.

FIG. 2. Completed stack of peanut.

PICKING AND SHELLING

In the Philippines picking and shelling are accomplished by hand. This process is quite slow, laborious, and expensive, and becomes impractical when the product is handled in great volume. Owing to this great expense, harvesting and picking are done under the sharing system. In general, one-fifth of the crop is given to the harvesters. In the United States, where peanuts are grown by the hundreds of acres, machinery is employed in the harvesting, picking and shelling.

Machinery having a capacity of 40 tons a day is in use in Manila, however, for the shelling and sorting of peanuts. It is owned by the Filipinas Products Company and is the only one of its kind in the Islands.

The best time to pick is during bright weather so the vines will be brittle and picking easier. During cool weather the vines are rather tough and picking is difficult. In the course of picking only the marketable pods are selected. The unmatured ones

are left. Properly picked pods should be free from stems, dried leaves, and other foreign materials.

Care should be taken not to press the pods too hard so as not to split the kernels in the process of shelling. Plenty of split kernels generally lower the quality of the product in the market. Injured or split kernels are easily attacked by mold in storage, hence they should be separated. The shelling percentage of the different varieties differs, as follows:

	Per cent
1. Zambales	78
2. Kinorales	77
3. Spanish	76
4. Native	74
5. Vigan Lupog	73
6. San Mateo	72
7. San Jose No. 3	72
8. Tennessee Red	68
9. Macapno	65
10. Cagayan No. 1	63

YIELD

Like any other crop, the yield of peanut varies with the season, locality, type and fertility of the soil, cultural method employed, degree of cultivation, diseases and pests, and other unavoidable factors.

The data below confirm these statements.

TABLE 4.—*Average yields of peanuts per hectare at 100 per cent stand for four years tests at Lamao Horticultural Station, Bataan.*

	Rainy season.		Dry season.		Average yield per hectare.		
	Pods.	Kernels.	Pods.	Kernels.	Pods.	Kernels.	
	Kilos.	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Cavans.*
Spanish	767.23	579.38	766.43	590.47	766.83	684.92	12.55
San Jose No. 3	747.22	542.67	879.18	637.86	813.20	590.26	12.69
Tennessee Red	855.64	589.65	782.89	525.80	819.27	557.73	11.99
Native	803.57	581.15	632.99	481.65	718.18	531.40	11.42
Vigan Lupog	780.52	544.67	652.98	502.40	716.75	523.53	11.26
San Mateo	669.04	470.76	799.08	584.52	734.06	527.64	11.13
Zambales	716.02	581.48	577.87	435.54	646.95	508.51	10.93
Kinorales	385.37	293.67	505.20	399.16	455.29	346.41	7.45
Jumbo [a]	681.88						
Virginia runner [a]	293.75						
Virginia bunch [a]	179.69						

[a] Yields obtained from the acclimatization test at Lamao.

There are differences in yields between the rainy season and the dry season of plantings of the same variety. Under La-

mao conditions, the San Jose No. 3, Tennessee Red, and Spanish varieties yielded the highest of 12.69 cavans, 12.55 cavans, and 11.99 cavans of kernels per hectare respectively.

TABLE 5.—*Variety test at Ilagan Tobacco Station, Isabela, Luzon.*

	Computed yield per ha.		Remarks.
	Pods.	Pods.	
	Kilos.	*Cavans.*	
Cagayan No. 1	1,244.13	19.53	The land was planted to corn. Planted January 22, 1931, and harvested June 3 to 10, 1931.
Cagayan No. 2	1,347.70	17.96	
Spanish	1,847.83	24.50	
Macapno	1,502.42	21.04	
San Jose No. 3	1,598.59	21.31	

Under Ilagan conditions the Spanish variety yielded the greatest of 24.50 cavans of pods per hectare followed by San Jose No. 3 which yielded 21.31 cavans and Macapno, 21.04 cavans. In spite of the long drought during the later part of the growing period and the rain which caused some of the pods to sprout at maturity, the average yield is comparatively higher than those obtained in Lamao.

Under Alabang soil and climatic conditions the following data were obtained from the 1932 dry season and 1933 rainy season cultures:

TABLE 6.—*Variety test at Alabang Rice Station.*

Variety.	Average mean weight in pods per plant.			
	1932		1933	
	Marketable.	Unmarketable.	Marketable.	Unmarketable.
	g.	*g.*	*g.*	*g.*
Virginia jumbo	46.02±2.10	13.33±0.79	43.24±3.19	7.38±0.59
Spanish	24.05±1.45	16.32±0.55	27.30±0.90	3.82±0.21
Vigan Lupog	18.91±0.83	15.20±1.11	26.43±0.62	4.87±0.13
Macapno	18.26±0.54	5.68±0.13	27.60±0.62	4.56±0.22
Biit	18.23±0.81	7.86±0.51	25.38±0.99	6.00±0.16
Mangoyai	17.65±0.51	4.54±0.34	30.20±0.83	4.77±0.25
Tirik	8.67±0.42	2.00±0.14	28.20±1.18	5.26±0.34
Singapore			24.50±0.78	5.40±0.38
Cagayan No. 1			23.80±1.65	4.80±0.21
Cagayan No. 2			20.70±0.51	5.20±0.15
San Jose			27.46±1.35	3.44±0.27

TABLE 7.—*Variety test of peanut at Los Baños, Laguna, Luzon.*

Variety.	Production per hectare (pods).		Average (pods).	Remarks.
	Wet season.	Dry season.		
	Cavans.	*Cavans.*	*Cavans.*	
Valencia	26.6	26.2	26.4	Wet season culture matured in 120 days while the dry season matured in 110 days.
Spanish White	26.6	24.9	25.7	
Vigan Lupog	26.0	24.0	25.0	
Kinorales	23.4	22.8	23.1	
Lemery	22.6	22.9	22.7	
Tarlac	22.4	21.8	22.1	
Spanish Red	18.1	20.7	19.4	

FEED FOR LIVESTOCK

Peanut hay is a very nutritive feed for livestock, comparing favorably with other forages as shown in the following table:

TABLE 8.—*Chemical analysis of the different livestock feed.*

[Analyzed by the Bureau of Science. The grasses were almost at the same stage of growth.]

Feed.	Moisture.	Fat.	Protein.	Ash.	Carbohydrate.	Remarks
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	
Peanut hay	81.14	0.39	2.42	1.96	14.00	Hay.
Guinea grass	72.69	0.49	1.72	2.70	22.40	Fresh.
Para grass	85.37	0.35	2.18	2.10	10.00	Do.
Balili grass	85.02	0.31	2.60	1.74	10.33	Do.
Dallis grass	71.73	0.52	1.59	1.99	24.16	Do.
Guatemala grass	87.38	0.29	1.12	1.73	8.48	Do.
Rice straw	12.80	0.65	3.20	11.94	34.30	Straw.
Corn stover	40.50	1.10	3.80	3.40	31.50	Fresh.

In the United States the hogs are allowed to enter into the peanut field and harvest the pods themselves. The peanut cake (residue after extraction of the oil) is also an excellent feed for hogs. The broken kernels serve as poultry feed.

MARKETING

The peanut is usually sold in the local markets by the cavan either in the form of dry pods or shelled nuts. Approximately 30 kilograms of nuts make a cavan. In other countries, however, the peanut is sold by weight. In fact, our importation of the peanut is registered in term of kilograms. This procedure should also be adopted in the Philippines because of the difference in the size of pods of the different varieties. Newly picked or wet pods are sometimes marketed for boiling purposes.

Peanuts for the market should be free from extraneous matter, as stems, leaves, soil, etc., faulty nuts, and pops. Thoroughly prepared peanuts for the market are almost of uniform size with bright-colored shells and command better prices.

Cleaning may be done by winnowing in strong wind, as in the case of rice. Soiled pods should be washed in clean water during bright and hot day, so that drying will be quicker.

The price of peanuts fluctuates according to the supply and demand. For the year ended June 30, 1932, the average price was ₱0.105 per kilogram of nuts. The price per cavan of shelled peanut was about ₱7.

COST OF PRODUCTION

The cost of raising a hectare of peanuts varies, depending upon locality, type of soil, variety, method and extent of cultivation, method of harvesting, labor conditions in the locality, etc.

Paulino reported the following cost of production under Ilagan, Isabela, conditions:

TABLE 9.—*Cost of production per hectare.*

Operation.	Days required.	Man labor.		Animal labor.		Total cost.	Implements.
		No.	Cost.	No.	Cost.		
Land preparation:							
1st plowing	5	2	₱10.00	2	₱5.00	₱15.00	Vargas plow.
1st harrowing	3	1	3.00	1	1.50	4.50	Iron harrow.
2d plowing	4	2	8.00	2	4.00	12.00	Vargas plow.
2d harrowing	2	1	2.00	1	1.00	3.00	Iron harrow.
3d plowing	3	2	6.00	2	3.00	9.00	Vargas plow.
3d harrowing	2	1	2.00	1	1.00	3.00	Iron harrow.
Cost of seed		(b)				4.50	
Cost of shelling	3	2	3.00			3.00	Hand shelling.
Planting:							
Furrowing	1.5	[b] 1	1.50	1	0.75	2.25	Vargas plow.
Planters	1.5	2	1.50			1.50	By hand and feet.
Cultivation:							
1st cultivation	2	1	2.00	1	1.00	3.00	Five-tooth cultivator.
2d cultivation	2	1	2.00	1	1.00	3.00	Do.
3d cultivation	4	1	4.00	1	2.00	6.00	Vargas plow.
Harvesting [a]						(d)	Hand pulling and picking.
Drying pods	(c)	2	5.60			5.60	Canvass.
Hauling pods		1	1.00	1	0.50	1.50	Cart.
Cost of sacks	0.5					10.56	Double gunny sacks.
Total	41.5	20	51.60	14	20.75	87.41	

[a] Harvesting of peanuts should be done under the share system, giving generally one-fifth of the crop to the harvesters who will do the pulling of the plants and picking of the pods. It is very expensive to carry out the work through hand picking of the pods by wage laborers.

[b] Women.

[c] Eight working only 0.5 day.

[d] Share system.

Battung (1933), a senior student of the College of Agriculture, Los Baños, Laguna, reports that the cost of production per hectare of peanuts in the wet season was ₱86.57 and ₱77.22 in the dry season.

DISEASES AND PESTS

The commonest disease of the peanut in the Philippines is the leaf spot caused by *Cercospora personata*. It is characterized by the presence of small brown to dark brown spots on the leaves when the plants approach maturity. It does not cause serious injury as it appears when the plants are maturing. Rotation of crops may minimize its occurrence.

Rats cause serious trouble by digging and eating the pods. One of the most effective control measures is poisoning with white arsenic in the following mixture: one part of white arsenic, six parts of cooked rice and one part of shredded coconut thoroughly mixed together. The bait is placed in bamboo tubes, large enough for the rats to get in. These tubes are placed in the infested field, preferably late in the afternoon.

Crows also do some damage by pulling up the plants and the pods. Scaring or shooting them are the control measures.

HANDICAPS OF THE PHILIPPINE PEANUT INDUSTRY

Most of the peanut business in the Islands is handled by foreigners, particularly the Chinese and the Japanese. Owing to this fact, most of the peanuts sold in various forms as salted, roasted, boiled, candied, etc. in the stores, restaurants, and hotels, are imported from their respective countries. The experience of some great producers and middlemen has shown that when these foreigners are offered the local produce, they bid quite a low price and reason out that they cannot buy much because they have a contract with some producers in their respective countries.

SOME HINTS ON THE IMPROVEMENT OF THE INDUSTRY

1. Imposition of tariff on imported peanut and peanut products.
2. Classification and grading of peanuts according to some standards.
3. Propagation of highest yielding variety.
4. Increase of the yield per hectare through selection of high yielding strains.
5. Lowering of the cost of production through improved method of cultivation with the use of efficient modern implements.

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ILLUSTRATIONS

VARIOUS PEANUTS GROWN IN THE PHILIPPINES

PLATE 1

FIG. 1. Spanish.
2. San Jose No. 2.
3. San Mateo.

PLATE 2

FIG. 1. Kinorales.
2. Zambales.
3. North Carolina Runner.

PLATE 3

FIG. 1. Vigan Lupog.
2. Tennessee Red.

PLATE 4

FIG. 1. San Jose No. 1.
2. San Jose No. 2.

TEXT FIGURES

FIG. 1. Pole around which peanuts are to be stacked.
2. Completed stack of peanuts.

PLATE 1.

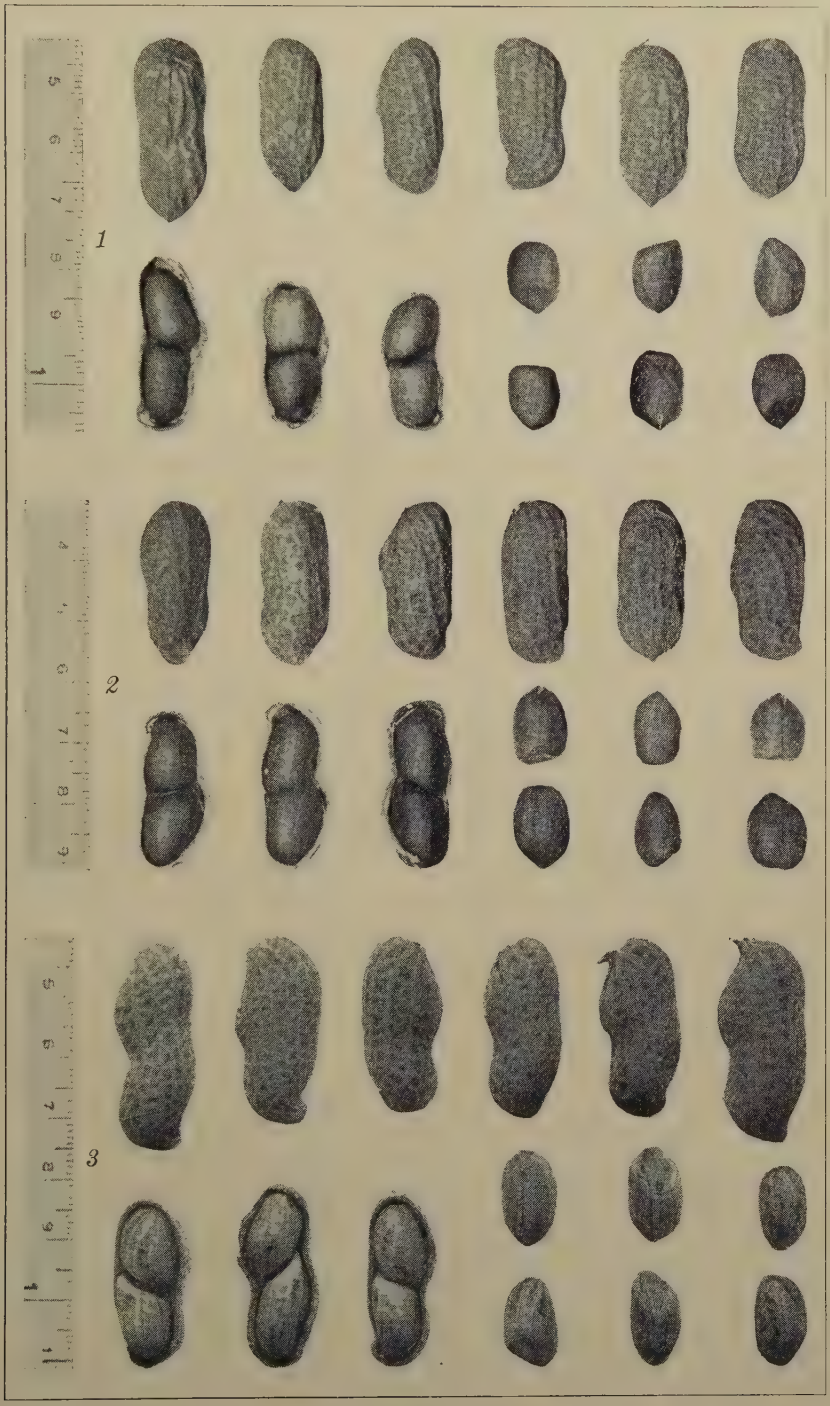

PLATE 2.

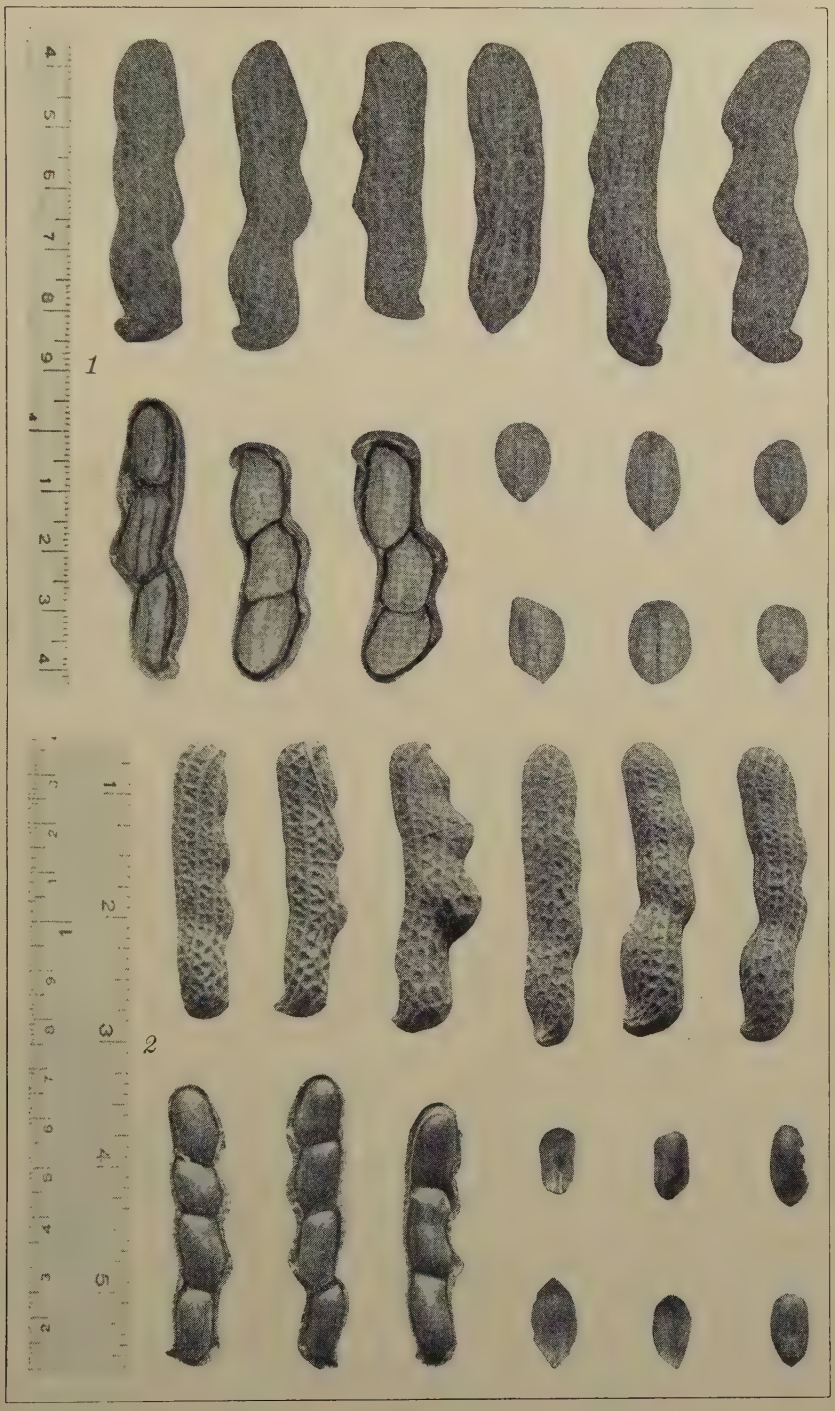

PLATE 3.

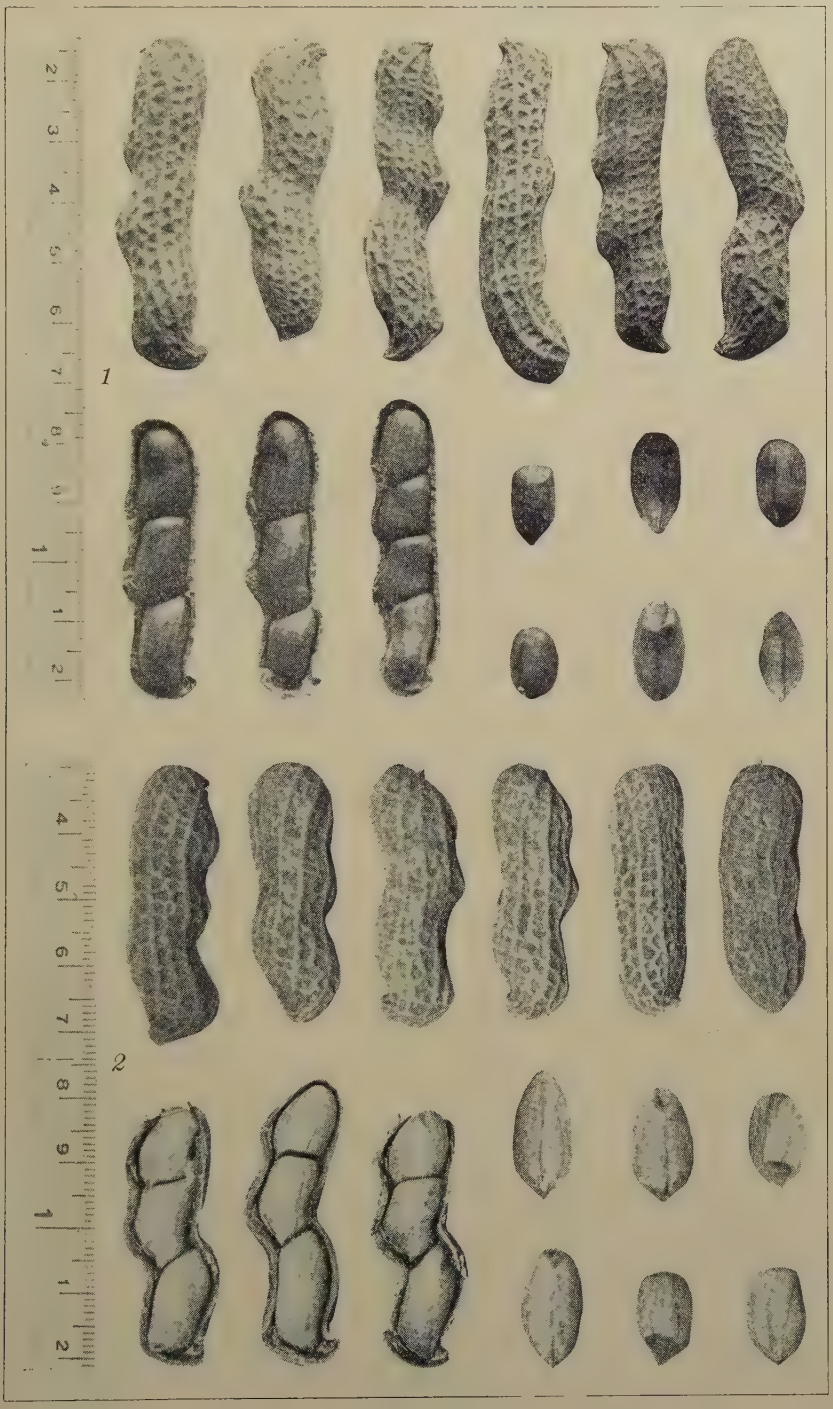

PLATE 4.

PRESENT PHILIPPINE STANDARD VARIETIES OF TOBACCO

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FOUR TEXT FIGURES

Tobacco was introduced into the Philippines by the Spanish missionaries already in the latter part of the sixteenth century, but not until 1896 were the varieties under cultivation described. In the cultures of the Estación Agronómica de la Isabela in 1891 Priego(7) was able to distinguish the following five varieties: Pampano, Darulug, Romero, Vizcaya and Espada. Inasmuch as Priego was certain that the last two varieties were not introduced until the earlier part of the nineteenth century, we may assume that up to that time there must have been only three primary varieties cultivated in the Philippines. In the same year, however, Priego(6) also reported that during the season of 1895–1896, he introduced into Isabela Province the following foreign varieties:

Debroc, Czetnek, and Verpelet, from Hungary.
Havannensis, from Cuba.
Maryland, Connecticut, Kentucky (Ordinary), and Kentucky (Burley), from the United States.
Turkish, from Turkey.
Delhi, from India.

In view of the fact that during the turbulent years at the turn of the century the valuable agronomic works of the Spaniards were virtually wiped out, the number of varieties of tobacco now found in the country, especially in Cagayan Valley, is surprisingly great.

Subsequent introductions of foreign varieties were effected during recent years largely through the efforts of the College of Agriculture, University of the Philippines, and the former Bureau of Agriculture (now the Bureau of Plant Industry). The following workers from the former have reported the foreign varieties indicated after their respective names:

Tirona(8) 1914.
Connecticut Broadleaf, Connecticut Havana.
Gagurangan(1) 1916.
Texas Cuban, Lowland Turkish.

Leaño (5) 1919.
Judy's Pride, White Burley, Improved Goldleaf, Warne, White Stem Orinoco, Gooch and Adcock.
David (2 and 3) 1925.
Goldleaf.

Table 1 shows the foreign varieties introduced by the Bureau of Agriculture as succeeded by the Bureau of Plant Industry, the year they were first tried, and the places where the trials were made.

It is obvious that all tobacco varieties grown at present in the Philippines are of foreign origin, but for purposes of this paper those that have been under cultivation prior to 1900 will be referred to as native varieties, and those introduced since 1900, as foreign. The Spanish agronomists prior to 1900 introduced four American, three Hungarian, one Cuban, one British Indian, and one Turkish varieties, but these have either naturally disappeared or lost their identities through the dominance of the native varieties. Although not less than sixty-eight foreign varieties were introduced recently into the Philippines from 10 different countries, only 6 have been standardized under Philippine conditions to date. This number may be reduced even further, unless those introduced during the present season and not yet included in Table 1, will replace the varieties that have been lost.

CLASSIFICATION OF TOBACCO VARIETIES

Tobacco varieties are first grouped into types, based upon their primary utilization in the tobacco industry. In the Philippines any standard variety may fall under any of the following types: (1) Cigar wrapper, (2) cigar filler, (3) cigarette filler, (4) miscellaneous (Batek, Romero, and Sulcok).

By standard variety of tobacco is meant any variety differing constantly in one or more characters from another and having commercial value. As one species of *Nicotiana*, namely, *tabacum*, is cultivated in the Philippines, all varietal references in this paper are understood to be to this species only.

The different types are characterized mainly as follows:

(1) *Cigar wrapper.*—Tall growth and erect; medium to medium-large, ovate or roundish, fine-veined, erect leaves.

(2) *Cigar filler.*—Tall to very tall growth; mostly horizontal, large to very large, coarse-veined leaves with mild aroma and long internodes.

(3) *Cigarette filler.*—Medium growth; small to large aromatic leaves which cure yellow under certain conditions; coarse-veined, and close internodes.

(4) *Miscellaneous.*—The *Romero* has a peculiar aromatic dark leaf that appeals to a special group of smokers. In the Ilocos and Pangasinan provinces the varieties *Marogui* and *Vizcaya* become *Batec,* because both have the capacity to develop plenty of spots ("batec" in Ilocano) through very low topping and delayed harvesting with very dry weather during the growing period of the plant.

The following are the bases of the quantitative terms used in this paper:

Tallness or growth.—Very tall (more than 200 cm), tall (165 to 199 cm), medium (125 to 164 cm), short (75 to 124 cm), and dwarf (less than 75 cm).

Size of leaf.—Very large (more than 65 cm long), large (50 to 64 cm), medium (35 to 49 cm), and small (less than 35 cm).

Stockiness.—(Based on the middle circumference of the stalk.) Very stocky (more than 7 cm), stocky (6.5 to 7 cm), medium (6 to 6.4 cm), slender (less than 6 cm).

Number of leaves.—Very many (more than 30 standard leaves), many (23 to 29), fair (16 to 22), and few (less than 16).

TABLE 1.—*List of foreign varieties of tobacco introduced by the Bureau of Agriculture (now the Bureau of Plant Industry), the year they were first tried, and the places of trial.*

Variety name.	Origin.	Year first tried.	Place of trial.
Sumatra		1903	Pampanga.
Vuelta Abajo	Cuba	1918	Isabela.
Havana	United States	1918	Do.
Sumatra	do	1918	Do.
Blumenstiel	do	1918	Do.
Florida Sumatra	do	1920	Isabela and Cotabato.
Phil. Baker Sumatra	Sumatra	1920	Cotabato.
Havanensis	Cuba	1920	Do.
Dumbara	Ceylon	1921	Isabela.
Olsen No. 1	Turkey	1921	Isabela and Cotabato.
Connecticut Havana	United States	1921	Isabela.
Connecticut Seedleaf	do	1921	Isabela and Cotabato.
Connecticut Broadleaf	do	1921	Do.
Orinoco	do	1921	Isabela.
Connecticut Round Tip	do	1921	Cotabato.
"A" (P. I. No. 7836)	Unknown	1921	Do.
"B" (P. I. No. 7836)	do	1921	Do.

TABLE 1.—*List of foreign varieties of tobacco introduced by the Bureau of Agriculture (now the Bureau of Plant Industry), the year they were first tried, and the places of trial*—Continued.

Variety name.	Origin.	Year first tried.	Place of trial.
Batoli	Unknown	1921	Cotabato.
Bahia	Brazil	1923	Isabela.
S. P. No. 1	Unknown	1924	Isabela and Cotabato.
S. P. No. 2	do	1924	Do.
Baker's Sumatra	Sumatra	1925	Isabela.
Havanensis	Cuba	1926	Do.
Dutch	United States	1927	Do.
Spanish	do	1927	Do.
Tal Zimmer	do	1927	Do.
Kavalha	Turkey	1927	Isabela and Cotabato.
Manyleaf Soulouk	South Africa	1927	Do.
Stewart Cuban	United States	1928	Isabela.
Hockanum Seedleaf	do	1928	Do.
John William Seedleaf	do	1928	Do.
Maryland Mammoth	do	1928	Do.
Stand White Burley	do	1928	Do.
Red Burley	do	1928	Do.
Adcock	do	1928	Do.
Smetzer's White Burley	do	1928	Do.
Virginia Brigh	do	1928	Do.
North Carolina Bright Yellow	do	1928	Do.
Goldleaf	do	1928	Do.
Longleaf Gooch	do	1928	Do.
Connecticut Round Tip	do	1929	Do.
Goundie	Germany	1929	Do.
Fortheimer	do	1929	Do.
Gaudertheimer	do	1929	Do.
Friedrichsthaler	do	1929	Do.
Harinapali	British India	1929	Do.
Mandhatta	do	1929	Do.
Turkish	Turkey	1929	Do.
Samsoun Bafra	do	1929	Do.
J. Kelly White Burley	United States	1929	Do.
Stand-up White Burley	do	1929	Do.
Howells White Burley	do	1929	Do.
Arkadia Tyck Kulok	Russia	1930	Do.
Havana	do	1930	Do.
Samson	do	1930	Do.
Trebizond	do	1930	Do.
Platana Arcadia	do	1930	Do.
Diubec	do	1930	Do.
Jamaica	United States	1933	Los Baños.

STANDARDIZATION OF NATIVE VARIETIES

By right of priority the names *Pampano, Darulug, Romero, Vizcaya, Espada,* used by Priego in 1896 to describe the five native standard varieties, should be retained in connection with

any work on the standardization of native varieties in so far as Priego's descriptions are consistent. Contemporary work along this line was started in Cagayan Valley in 1923. Curiously enough virtually all of Priego's varieties persisted in that region despite the defective methods employed by the tobacco growers to keep them pure. While the name "darulug" has disappeared, the description of Priego almost tallies with that of the present "marogui" the local synonym of which is "Espada Baculao." One standard native variety, however, has been found in the valley in addition to the five recognized ones. This variety is rightly named "Repollo" because of the whorl-like arrangement of its erect leaves.

All of the tobacco varieties peculiar to Cagayan Valley, with the exception of Romero, belong to the cigar filler type. Romero may be included for the present under the miscellaneous type, for while its leaves are aromatic, they are too dark for cigarette filler type standards. It is grown at present in limited patches by farmers who have a special taste for aromatic but strong dark tobacco smoke. Romero is characterized by its medium height but large stalk and its few, horizontal, broadly ovate, petiolate and medium-sized leaves (text fig. 1).

The five standard native cigar filler varieties are commonly characterized by their tall to very tall height, large to very large stalks, and their many large to very large sessile leaves. They are distinguishable from one another chiefly by the shapes and positions of their leaves. Espada is readily recognized by its very narrow or lanceolate leaves; Repollo by its erect medium-broad elliptic leaves; Pampano by its horizontal, very undulating, broadly ovate dark green leaves; Marogui by its partly erect, slightly undulating, light green and ovate leaves; and the Vizcaya by its broadly elliptic horizontal leaves (text fig. 2).

Tobacco is of course cultivated in practically every province, but the regions next to Cagayan Valley in importance are the Ilocos coast, the northern belt of Central Luzon Plain, and the larger Visayan Islands, except Samar and Bohol. As tobacco was extensively grown also in these regions during the Spanish regime, and as prior to 1900 the native varieties were of the same origin, and because of the traditional yearly practice of the Compañia General de Tabacos de Filipinas, the largest Philippine tobacco firm, of distributing tobacco seeds produced in Cagayan Valley in practically every province which raises tobacco for the open market, one would naturally suppose that when the work of standardizing the nomenclature of Philippine varieties

was started, seeds were obtained of every supposedly distinct variety of tobacco grown in the other provinces. The seeds were propagated in our Ilagan Tobacco Station and the resulting plants compared with Cagayan Valley standard varieties. The results are indeed consistent with our expectations. As Table 2 shows,

FIG. 1. Petiolate leaf of the tobacco variety Romero; *a*, inflorescence leaf; *b*, middle standard leaf. One-fourth natural size.

with the possible exception of one or two varieties, every variety tried has its counterpart or synonym among those of Cagayan Valley. In addition to the varieties listed in Table 2, actual surveys in the Ilocos Provinces and Visayan islands revealed fourteen varieties identical with those of Cagayan Valley, as shown in Table 3.

The work on the standardization of native varieties is by no means completed. It is hoped that the adoption of a system of

FIG. 2. Elliptical leaf of the tobacco variety Vizcaya; *a* inflorescence leaf; *b*, middle standard leaf. One-fourth natural size.

accurate synonymy of the numerous varietal names will be of considerable aid to the tobacco trade in general and the tobacco manufacturers in particular.

TABLE 2.—*Tobacco varieties from other Philippine regions compared with Cagayan Valley standard varieties through actual tests at the Ilagan Tobacco Station.*

Variety.	Regional source.	Cagayan Valley standard variety equivalent.
Cacites nga Lubag	Eastern Visayas	Romero.
Antolin	Northern Central Luzon Plain	Do.
Pangasinan	do	Repollo.
Isabela	do	Do.
Kaviteño	do	Espada.
Dinumero	do	Do.
Espada	do	Do.
Batec	Ilocos provinces	Vizcaya.
Alicano	Western Visayas	Repollo.
Barocana	do	Do.
Siate	do	Do.
Morada	Itawes District	Romero.
Waracisois	do	Do.
Capigued	do	Do.
Bacari	do	Do.
Tettalay	do	Do.
Iloilo	Western Visayas	Appears to be a different and therefore a new variety.

TABLE 3.—*Tobacco varieties from other Philippine regions compared with Cagayan Valley standard varieties through actual survey of the regions.*

Variety.	Region where grown.	Cagayan valley standard variety equivalent.
Pampano	Ilocos	Pampano.
Salopingpingan	do	Do.
Bansuroy	do	Marogui.
Batec	do	Marogui and Vizcaya.
Repollo	do	Repollo.
Cagayan	do	Espada.
Al-langigan	do	Do.
Renta-Pugot	do	Romero.
Romero	do	Do.
Lapondan	Western Visayas	Vizcaya.
Siate	do	Repollo.
Cacites	Eastern Visayas	Romero.
Berlin	do	Vizcaya.
Barili	do	Do.
Simmaba	La Union	Marogui.
Limmogo	do	Do.

ACCLIMATIZED STANDARD FOREIGN VARIETIES

The Philippine Baker Sumatra variety was first planted in Cotabato valley in 1921 and in Cagayan Valley during the 1924–1925 season. As the official name of the variety shows, its introduction into the Philippines is due to the late Dean Baker.

Indeed this variety made possible the first successful production of open grown cigar wrapper leaf tobacco in the country. It is in fact still the chief variety raised by the Compania General de Tabacos de Filipinas in its haciendas in Isabela Province. It is identical with genuine Sumatra and is characterized by tall but rather slender growth and many erect, ovate, fine-veined, undulating-margined, acute-apexed, and fine-textured, although medium-sized leaves.

The Samsoun Bafra was introduced direct from Turkey through the efforts and courtesy of the American Consul at Constantinople in 1928. This variety is indeed one of the famous Turkish cigarette varieties. It is easiest to distinguish of all the varieties mentioned in this paper because of its small petiolate, ovate and erect leaves. Unfortunately, because of the smallness of its leaves, it will have to overcome the prejudice of our tobacco growers before they will even try it.

We have six standard varieties of American origin, all belonging to the cigarette type. They are all of medium height and development with more or less short internodes. The White Burley is most easily recognized because of its decidedly chlorotic leaves. It is also distinguishable from the other three American varieties by the fact that notwithstanding its chlorotic color in the field, it does not cure bright yellow as the others. Its peculiar aroma and mildness, however, render it indispensable for blending purposes in the manufacture of American style cigarettes. The Orinoco is also easy to recognize because of its characteristic lanceolate, narrow, erect leaves (text fig. 3). The Warne is the tallest of the American varieties and the North Carolina Bright Yellow has the roundest leaves with a breadth index of over 50 per cent, while the Big Warne has distinctly ovate leaves just as the Warne. The last four American varieties are supposed to belong to the so-called Bright group.

NEW STANDARD VARIETIES

Perhaps because the most important contemporary Philippine tobacco problem was the production of cigar wrapper leaf tobacco, tobacco breeding work was first directed toward the production of new strains and varieties of the cigar wrapper type. This work naturally followed two courses—pure line selection and hybridization with subsequent selection.

The pioneer work on tobacco hybridization in the Philippines was that of Tirona(8) performed in 1914 at Los Baños, Laguna. From a cross between the Connecticut Broadleaf and Cagayan

(probably the Marogui variety), Tirona produced a hybrid which bore his name and which for a time became quite famous. For some reason, however, we hear no more of this hybrid.

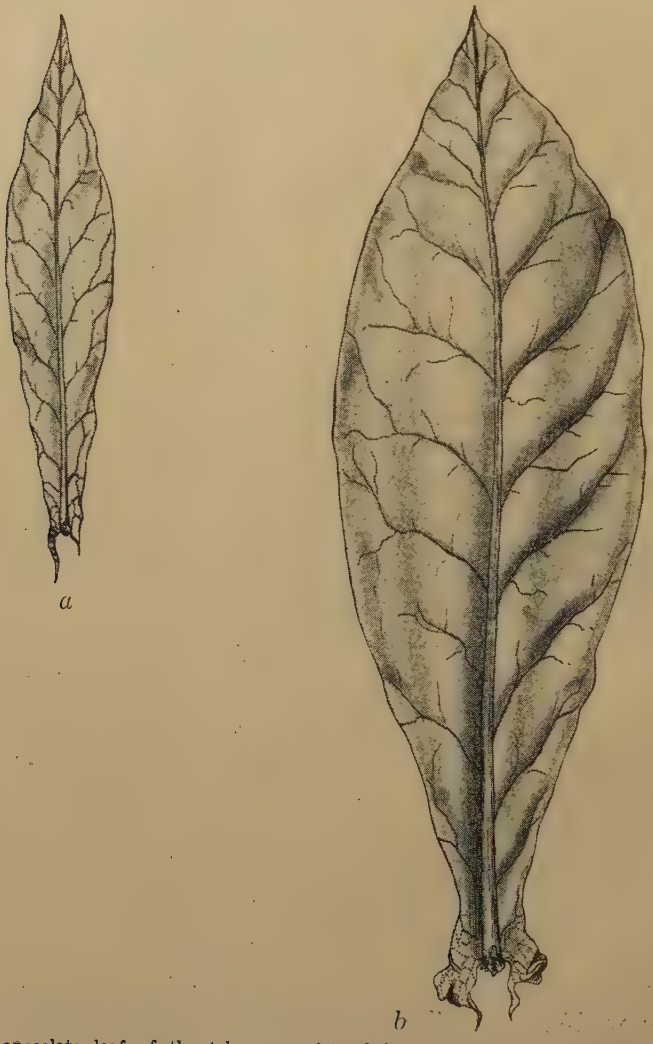

FIG. 3. Lanceolate leaf of the tobacco variety Orinoco; *a*, inflorescence leaf; *b*, middle standard leaf. One-fourth natural size.

Gutierrez(4) in the early part of 1922 crossed the varieties Philippine Baker Sumatra and Philippine Florida Sumatra and obtained a hybrid which he called the Bx. This hybrid now breeds constant and therefore may be called a standard variety. Because of the close relationship of the parent varieties, and

perhaps because of the possible staminate parent dominance, the Bx very closely resembles its male parent—the Philippine Baker Sumatra. The differences lie only in the taller growth and more undulating and darker green color of the leaves compared with those of the male parent variety. One decided advantage

FIG. 4. Ovate-orbicular leaf of the tobacco variety Ilagan Sumatra; *a*, inflorescence leaf; *b*, middle standard leaf. One fourth natural size.

of the *Bx* over the Philippine Baker Sumatra is its superior hardiness and consequent ability to do better under less favorable conditions.

The Philippine Baker Sumatra is a perfectly satisfactory cigar wrapper variety, but, principally because of the prejudice of the Filipino tobacco grower against small and medium leaved

varieties, intensive pure line selection was started during the 1924–1925 season at the Ilagan Tobacco Station, to develop a strain which if possible will produce bigger and rounder wrapper leaves. At this time the mean breadth index of the Philippine Baker Sumatra was 52.78 per cent. During the 1928–1929 season a strain with virtually 70 per cent breadth index was developed. This strain, differing from the original variety in at least two important characters and being true to type, naturally is called a distinct standard variety of the cigar wrapper type. The variety has been called Ilagan Sumatra to commemorate the town of its origin. This variety differs principally from the Philippine Baker Sumatra by its wider and larger leaves. The Ilagan Sumatra has ovate-orbicular leaves (text fig. 4) while the Philippine Baker Sumatra has ovate leaves.

KEY FOR THE PRACTICAL IDENTIFICATION OF THE STANDARD TOBACCO VARIETIES

Following the example of botanists I have prepared a key for the practical identification of the standard tobacco varieties mentioned in this paper. By selection of the most conspicuous variety and gradual elimination, every variety is finally identified.

Key to standard tobacco varieties.

a^1. Leaves decidedly chlorotic..... White Burley.
a^2. Leaves green.
  b^1. Leaves petiolate.
    c^1. Leaves medium, few ..... Romero.
    c^2. Leaves small, many..... Samson Bafra.
  b^2. Leaves sessile.
    c^1. Plants tall to very tall.
      d^1. Leaves large to very large, coarse veined; plants stocky.
        e^1. Leaves broadly ovate, dark green, very undulating.. Pampano.
        e^2. Leaves otherwise.
          f^1. Leaves narrow, lanceolate..... Espada.
          f^2. Leaves elliptic or ovate.
            g^1. Leaves ovate ..... Marogui.
            g^2. Leaves elliptic.
              h^1. Leaves erect, medium..... Repollo.
              h^2. Leaves horizontal, broader..... Vizcaya.
      d^2. Leaves medium or medium-large, fine veined, erect; plants rather slender.
        e^1. Leaves broadly ovate or rounded, medium large. Ilagan Sumatra.
        e^2. Leaves ovate, medium.
          f^1. Leaves undulating; plants taller. Philippine Baker Sumatra.

f^2. Leaves very undulating; plants less tall..... Bx.
c^2. Plants medium in height; leaves medium to large.
d^1. Leaves lanceolate or narrow, erect-Orinoco.
d^2. Leaves broader.
e^1. Plants somewhat tall..... Warne.
e^2. Plants decidedly medium.
f^1. Leaves large, ovate..... Big Warne.
f^2. Leaves medium.
g^1. Leaves ovate elliptical ..... Adcock.
g^2. Leaves, broadly ovate..... North Carolina Bright Yellow.

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ILLUSTRATIONS

TEXT FIGURES

FIG. 1. Petiolate leaf of the tobacco variety Romero; *a*, inflorescence leaf; *b*, middle standard leaf. One-fourth natural size.

2. Elliptical leaf of the tobacco variety Vizcaya; *a*, inflorescence leaf, *b*, middle standard leaf. One-fourth natural size.

3. Lanceolate leaf of the tobacco variety Orinoco; *a*, inflorescence leaf; *b*, middle standard leaf. One-fourth natural size.

4. Ovate-orbicular leaf of the variety Ilagan Sumatra; *a*, inflorescence leaf; *b*, middle standard leaf. One-fourth natural size.

THE HANDLING OF SOME PHILIPPINE FRUITS WITH SPECIAL REFERENCE TO THE ETHYLENE, BORAX, AND PARAFFIN TREATMENT [1]

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The use of ethylene gas (C_2H_4) as a means of forcing the development of color in citrus fruits was patented by Dr. F. E. Denny, of the United States Department of Agriculture, in 1923. Several gases that will bring about artificial coloring were known at that time, but ethylene is the safest and most practical of those discovered. Denny and his co-workers have preferred not to use the term "ripening" in describing the effects produced.

Studies on the effect of ethylene on various fruits and vegetables at the Minnesota Agricultural Experiment Station in 1924 gave positive results, especially with celery and tomatoes. The application of ethylene in the blanching of celery was a commercial success. By taste and by chemical analysis ethylene treated celery was found to be higher in sugar than the untreated celery. It was also found that tomatoes treated with etheylene were sweeter than the untreated ones.

Subsequent investigators of the U. S. Bureau of Chemistry and Soils reported that there is no decided change in the composition of the edible portion of citrus brought about by the ethylene method of coloring. The sugar and acid contents of the fruits were practically the same. No pronounced difference was noticed between the treated and untreated oranges except in color. With some fruits, however, like persimmons, they concluded that the color was enhanced and the astringency lessened or destroyed.

Experiments on the use of ethylene on other fruits were equally successful. Pears for canning are picked when hard and green and stored in cellars or in cold storage. The fruit softens and colors unevenly, and it becomes necessary to sort it several times in order to obtain materials suitable for canning. The

[1] Read before the Second Philippine Science Convention held at Manila, February 17, 1933.

ethylene treatment of pears showed that the fruits were softened considerably after four days. Untreated pears required from ten to fourteen days to soften and 18.2 lbs. pressure to puncture the flesh of the pears, while the treated fruit required 5.5 lbs. The treatment of apricots and peaches did not seem to give satisfactory results. These fruits soften quickly after harvesting and contain no starch which could be converted into sugar.

PROPERTIES OF ETHYLENE

Ethylene is a colorless gas of faint, pleasant odor with a boiling point of—103° C., and specific gravity 0.97. The gas accelerates the coloring and ripening processes of fruits and vegetables. Its use not only shortens the time of ripening but also lowers the acidity of early apples, plums, and pineapples. It also eliminates packing house and shipping losses due to rot, fungus growths and uneven ripening.

Ethylene can be procured in cylinders under a pressure of 1,200 lbs. per square inch. It is inflammable and forms explosive mixtures with air when mixed with it in the proportions between 3 and 20 per cent. There is, however, little danger of inflammability when the maximum concentration used for coloring is not over 1 part of the gas in 1,000 parts of air. The gas has no effect on animal life at this dilution. The cylinders should be handled with care, and should not be exposed to unusually high degrees of heat. No light or fire should be allowed in the room where the containing cylinder and measuring apparatus are kept, especially during the treating process. Measuring gauges accompany a cylinder of the gas in order to measure the dosage of the injected gas, when delivered under such high pressure. In the absence of compressed gas, ethylene can be prepared in the laboratory by heating alcohol with concentrated sulphuric acid to 170° C. and passing the gas through concentrated sulphuric acid and sodium hydroxide to remove impurities such as sulphur dioxide, alcohol, and ether.

It is the purpose of these experiments to find out the effect and utility of ethylene treatment on Philippine fruits. Native oranges, principally the Batangas mandarin, are usually still green in color when picked and sold in the markets. No treatment is given the fruits except the grading for size and curing by storage in underground cellars. Although they are sweet after curing the fruits remain green in color. If the green color of the native oranges can be transformed into a uniform bright yellow by ethylene treatment, the attractiveness and the mar-

ket cost will be increased. There are other fruits besides the citrus, such as mangoes, avocados, lanzones, etc., that may commercially be treated to advantage with ethylene. In addition to ethylene treatment, other processes of handling fruits such as the borax and paraffin treatments which are as yet unknown here but which are regular commercial operations in fruit districts of many foreign lands which if properly studied and applied to our fruits may produce profitable results. A 4 to 5 per cent borax solution is used in commercial packing houses for dipping the fruits to prevent mold wastage. The fruits are then dried and polished with paraffin with the aid of mechanical brushes.

MATERIALS

The fruits studied include the following:

1. Varieties of oranges.
2. Varieties of grapefruits.
3. Pummelos, limes, and lemons.
4. Mangoes, carabao and pico varieties.
5. Chicos.
6. Avocados.

Practically all fruits studied were harvested from the Bureau of Plant Industry's experimental and propagation farms.

EQUIPMENT

Cylinder of ethylene gas at 1,200 lbs. pressure.
Measuring gauge.
Pyrex distilling flask.
Air pump.
Wash bottles.
Burners.
Ethylene chambers.
- (*a*) One of 101 cubic feet capacity
- (*b*) One of 5 cubic feet capacity
- (*c*) Tanauan ethylene chamber of 537 cubic feet capacity.

MATERIALS (CHEMICALS)

Alcohol, 95 per cent.
Sulphuric acid.
Sodium hydroxide.
Borax.
Paraffiin wax.

EXPERIMENTAL

The fruits are arranged carefully in racks inside the ethylene chamber, the door shut tight, and ethylene injected into the chamber in concentrations of 1:1000 and 1:5000. The injection

of the gas is done once every 24 hours. Every day thereafter until the treatment is completed, the chamber is aërated for about two hours before the gas is injected again. The ethylene treatment is continued until the fruits are fully colored and soft.

Ethylene is obtained from a cylindrical tank under 2000 pounds pressure, and measured by passing through a gauge calibrated in cubic feet per minute. The time of injecting the gas into the larger box is not over one minute as its capacity is only 101 cubic feet. For the smaller chamber the period of injection is correspondingly decreased.

In other experiments, ethylene is generated by heating the calculated amounts of ethyl alcohol and concentrated sulphuric acid in a distilling flask at 170° C. The gas is purified by passing it through concentrated sulfuric acid and sodium hydroxide solutions. To drive all the gas generated into the chamber an ordinary foot blower connected to the distilling flask is used.

At the Tanauan Citrus Experiment Station, Tanauan, Batangas, the handling of citrus fruits on a bigger scale was started January 18, 1933. The volume of the ethylene chamber built for the ethylene treatment of citrus fruits was 537 cubic feet. It was 151 inches long, 88 inches high, and 75 inches by 65 inches wide on opposite sides. Batangas mandarin and Szinkom oranges were picked on the same day and loaded into the ethylene chamber.

The first charge of ethylene gas was applied at 4.30 p. m. January 18 by heating a calculated mixture of 7.5 cc of 95 per cent alcohol and 7 cc of concentrated sulphuric acid enough to produce ethylene gas in the proportion of 1 part of gas to 5,000 parts of air. The gas was passed for thirty minutes into the chamber that has been shut tight to prevent leaks.

The next day, January 19, the chamber was opened at 7.30 a. m. and aërated for two hours by blowing cold air into it by means of a blower connected to a small gasoline engine. Gas was applied at 9.30 a. m. and continued until 10.30 a. m. Gas was injected at 4.30 to 5.00 p. m. on the afternoon of the same day.

The chamber was opened at 7.40 a. m. January 20. A pronounced change in color of the fruits from green to yellow was noticed on the second day of treatment. After aërating for two hours the chamber was closed and gas admitted again for one hour. The chamber was not opened again until the next day, January 21, at 7:40 a. m. On the third day, 90 per

cent of both varieties of oranges were fully colored. The flavor of the Szinkom oranges was somewhat sweeter after the treatment. The fully colored fruits were removed from the chamber and soaked in a 3 per cent borax solution at about 40° C. for two to three minutes, and allowed to dry on a table at room temperature.

The remaining fruits which were still greenish were treated again with ethylene gas on the afternoon of January 21. The next day, January 22, some of the Szinkom oranges showed signs of burn from the effects of the ethylene gas.

After removing the citrus fruits from the ethylene chamber, the fruits were soaked in a 4 to 5 per cent borax solution at 46 to 49° C. for several minutes. This temperature aids materially in cleansing the fruit and at the same time helps in preventing rots such as pythiacystis or brown rots. The fruits are then dried in a heated chamber for a short time. A hot-air heated chamber is best for the purpose. After drying, the fruits are treated with a solution of paraffin in a white, odorless, and tasteless mineral oil solvent. The paraffin reduces moisture loss and probably slows the rate of respiration. The fruits are then packed carefully in boxes or crates and pre-cooled in cold storage at 35° F.

DISCUSSION OF RESULTS

The results of the ethylene treatment of different varieties of oranges are shown in Table 1. Oranges are colored bright yellow in from three to five days. The temperature should never be higher than 30° C., because there is great danger of wilting the fruits. Very high or low humidities should be avoided. When excessive doses of the gas are given the skin of the fruit is burned. In fruits that received too much gas, the skin turns brown, soft, and then decays. The flavor is also affected, by a gassy taste. Careful regulation of the flow of the gas and uniform treatment reduce the danger of burning the skin of the oranges to a minimum. No pronounced difference in the degree of sweetness of the treated and untreated oranges was noticed.

Szinkom oranges were colored bright yellow in three days. The treated Szinkom oranges had a sweeter flavor than untreated oranges. Batangas mandarins are also colored orange yellow in three days. Some fruits which possess a very thick skin take a longer time to color. The degree of sweetness of the oranges remains the same before and after treatment.

Results of the ethylene treatment of grapefruit are shown in Table 2. Grapefruit takes color in three to six days after ethylene treatment. Because of its thick peeling, there is very little danger of burning the skin, provided the dose given is not too much. In acidity and flavor there is practically no difference between the treated and untreated lots. Tables 3 and 4 give the results of the ethylene treatment of lemons and limes. Lemons are colored yellow in two to three days and limes in four to five days. The treated limes turned bright yellow after treatment without softening the fruit.

Table 5 gives the results of the ethylene treatment of mangoes. The carabao variety required six days to become fully ripe and golden yellow in color, while the pico variety took five days to ripen. Fully matured mangoes ordinarily ripen in six to seven days when packed with rice straw at room temperature. It seems, therefore, that there is very little hastening of the ripening or coloring process for mangoes by the ethylene treatment. More experiments will be run when fruits become available.

Experiments on the ethylene treatment of fully matured mangoes that were stored in cold storage at 35° F. for one month and covered with different packing materials, such as saw dust, rice hulls, rice ash, etc., to delay the ripening of the fruit, gave unsatisfactory results. The mangoes failed to ripen to the natural ripe state of the fruit that has not been kept in cold storage for a long time. The flavor is very poor, most of the samples have a sour taste, and the color of the peel is dark yellow. The fruit decays quickly after removal from cold storage.

Table 6 gives the results of the ethylene treatment of chicos. Chicos required two to three days to ripen by the ethylene treatment. The fruits are soft but firm. Fully matured chicos that are picked, washed, and dried in the sun for a few hours and stored in covered crates, ripen in three to four days.

Table 7 gives the results of the ethylene treatment of avocados. The varieties treated include the Pollock, Cardinal and Lyon varieties. Avocados received in the green condition were ripened in two to three days. The green color of the skin of the Cardinal variety turned brown upon ripening. The other varieties remained green. The treated purplish fruits are soft but firm.

Citrus fruits that have been treated with 4 per cent borax at 46° to 49° C., and dried and paraffined, presented a very good appearance. When stored at room temperature, these oranges

kept for two weeks in good condition. Delay in the ripening of the fruit is probably due to the slowing of the rate of respiration by the prevention of loss of moisture by sealing the pores of the peel with the invisible wax coating. Pre-cooling of the crate of fruits for about twenty-five hours at 35° F. before delivery also helps in the lengthening of the period in which fruits can remain in good condition. In the absence of cold storage, underground cellars or curing rooms will serve the purpose. Treated fruits should be kept in these cool rooms until they are shipped.

SUMMARY AND CONCLUSIONS

1. The treatment of Batangas mandarin, oranges, grapefruit, pummelos, lemons, and limes with ethylene gas showed that citrus fruits can be colored bright yellow in from three to six days. No pronouncd change is noticed in the taste between treated and untreated fruits. A concentration of 1 part gas to 5,000 parts of air once a day is recommended for citrus fruits.

2. The soaking of citrus fruits in 4 per cent borax, drying, and the application of paraffin wax to the fruits is recommended to prevent waste in oranges due to molds. Pre-cooling of the fruit is also necessary.

3. The ethylene treatment of mangoes and chicos seems to indicate that there is very little gain in the ripening period of the fruits.

4. Avocados were ripened by the ethylene treatment in two to three days.

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TABLE 1.—*Treatment of oranges with ethylene gas.*

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aëration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
3- 7-32	King mandarin, Tanauan, Batangas	80	1:5000			Green	Hard	Sweet	Good appearance.
3- 8-32	do	78	1:5000	2	1	do	do	do	Do.
3- 9-32	do	76	1:5000	2.5	2	Greenish yellow	Slightly soft	do	Do.
3-10-32	do	74	1:5000	2.5	3	Light yellow	do	do	Do.
3-11-32	do	74	Removed		4	Full yellow	do	do	No spoilage.
11- 4-32	Batangas mandarin	30	1:1000			Yellowish green	Firm, fine	Excellent	
11- 5-32 (Sunday)	do	30	1:1000			Pale yellow	do		
11- 6-32	do	30	No treatment	2		do	do		
11- 7-32	do	30	Removed from chamber.		3	Orange yellow	do	Excellent	No spoilage.
7-13-32	Sour oranges, Lamao	50	1:1000	3		Very green	Hard	Sour	Good appearance.
7-14-32	do	49	1:1000	3	1	Greenish yellow	do	do	Do.
7-15-32	do	48	1:1000	3	2	Light yellow	do	do	Do.
7-16-32	do	47	1:1000	3	3	Full yellow	do	Still sour	No spoilage.
10-13-32	Igorot orange		½ cu. ft. per min.			Green	Firm	Good	Good appearance.
10-14-32	do		do	2		Light yellow	do	do	
10-15-32 (Sunday)	do		do	2		Yellow	do		
10-16-32	do		No treatment						
10-17-32	do		Removed from chamber.		4	Orange yellow	Loose	Good	No spoilage.

10–13–32	Satsuma orange		⅛ cu. ft. per min.			Green	Firm	do	
10–14–32	do		do	2		Light yellow	do		
10–15–32 (Sunday)	do		do	2		Yellow	do		
10–16–32	do		do	(a)					
10–17–32	do		Removed from chamber.		4	Orange yellow	Loose	Good	No spoilage.
10–13–32	Triumph orange		⅛ cu. ft. per min.			Green	Firm	do	
10–14–32	do		do			do	do	do	
10–15–32 (Sunday)	do		do	2		Light yellow	do		
10–16–32	do		No treatment						
10–17–32	do		Removed from chamber.		4	Orange yellow	do	Good	One spoiled.
10–13–32	Natsu daidai	14	⅛ cu. ft. per min.			Green	do	do	
10–14–32	do	14	do			Light yellow	do	do	
10–15–32 (Sunday)	do	14	do			Yellow	do		
10–16–32	do	14	No treatment						
10–17–32	do	14	Removed from chamber.		4	do	Loose	Good	Three spoiled.
10–14–32	*Citrus webberi*	34	⅛ cu. ft. per min.			Green	Firm	do	
10–15–32 (Sunday)	do	34	do	2		do	do	do	
10–16–32	do	34	No treatment						
10–17–32	do	34	⅛ cu. ft. per min.	2		Greenish yellow	Loose		
10–18–32	do	34	do	2		Pale yellow	do		

TABLE 1.—*Treatment of oranges with ethylene gas*—Continued.

Day.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aeration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
10–19–32	Citrus Webberi	34	Removed from chamber.		5	Yellow	Loose	Good	Nine spoiled.
11– 4–32	do	15	1:1000			Green	Loose, rough	Sour, juicy	
11– 5–32 (Sunday)	do	15	1:1000	2		do	do		
11– 6–32	do	15	No treatment						
11– 7–32	do	15	1:1000	2		Pale yellow	do		
11– 8–32	do	15	Removed from chamber.		4	Yellow	do	Sour, juicy	Two spoiled.
11–15–32	St. Michael orange	4	1:1000			Light green	Firm, fine	Good	
11–16–32	do	4	1:1000	2		do	do		
11–17–32	do	4	1:1000	2		Yellowish green	do		
11–18–32	do	4	1:1000	2		do	do		
11–19–32 (Sunday)	do	4	1:1000	2		do	do		
11–20–32	do	4	No treatment						
11–21–32	do	4	1:1000	2		Yellow	do		
11–22–32	do	4	Removed from chamber.		7	do	do	Good	No spoilage.

TABLE 2.—*Treatment of grapefruit with ethylene gas.*

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aëration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
1– 6–33	Marsh, Tanauan	12	1:1000			Green	Hard	Good	Good appearance.
1– 7–33 (Sunday)	do	12	1:1000	3	1	Greenish yellow	do	do	Do.
1– 8–33	do	12	No treatment		2				
1– 9–33	do	12	Removed		3	Bright yellow	Soft but firm	Good	No spoilage.
1– 6–33	Walter, Tanauan	12	1:1000			Green		do	Good appearance.
1– 7–33 (Sunday)	do	12	1:1000	3	1	Greenish yellow	Hard	do	Do.
1– 8–33	do		No treatment		2	do	do		Do.
1– 9–33	do	12	Removed		3	Bright yellow	Soft but firm	Good	No spoilage.
1– 6–33	do	8	1:1000			Green	Hard	do	Good appearance.
1– 7–33 (Sunday)	do	8	1:1000	3	1	Greenish yellow	do	do	Do.
1– 8–33	do		No treatment		2				
1– 9–33	do	8	Removed		3	Bright yellow	do	do	Do.
11– 4–32	McCarthy grapefruit	6	1:1000			Yellowish green	Firm, smooth	do	Good appearance.
11– 5–32 (Sunday)	do	6	1:1000	2		Pale yellow	do		
11– 6–32	do	6	No treatment						
11– 7–32	do	6	1:1000	2		Yellow	do		
11– 8–32	do	6	Removed		4	Orange yellow	do	Good	No spoilage.

TABLE 2.—*Treatment of grapefruit with ethylene gas*—Continued.

Day.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aeration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
11– 4–32	Panuban grapefruit	5	1:1000			Green	Firm	Good	Good appearance.
11– 5–32	do	5	1:1000	2		Yellowish green	do		Do.
(Sunday)									
11– 6–32	do	5	No treatment						
11– 7–32	do	5	1:1000	2		Pale yellow	do		
11– 8–32	do	5	1:1000	2		do	do		
11– 9–32	do	5	1:1000	2		do	do		
11–10–32	do	5	1:1000	2		Yellow	do		
11–11–32	do	5	Removed from chamber.		7	Orange yellow	do		Two not uniformly colored.
11–15–32	Marsh grapefruit	8	1:1000			Light green	Firm, fine	Good	
11–16–32	do	8	1:1000	2		do	do		
11–17–32	do	8	1:1000	2		Pale yellow	do		
11–18–32	do	8	1:1000	2		Yellow	do		
11–19–32	do	8	1:1000	2		do	do		
(Sunday)									
11–20–32	do	8	No treatment					Good	
11–21–32	do	8	Removed from chamber.		6	Yellow	Firm, smooth		

TABLE 3.—*Treatment of mangoes with ethylene gas.*

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aëration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
3–31–32	Carabao; Lamao, Bataan	12	1:1000			Green	Hard	Acid	Good appearance.
4– 1–32	do	12	1:1000	3.5	1	do	do	do	Do.
4– 2–32	do	11	1:1000	2	2	Yellowish green	Slightly soft	do	Do.
4– 4–32	do	10	1:1000	2.5	4	Greenish yellow	Soft but firm	Sweet	Do.
4– 6–32	do	9	1:1000	2.5	5	Golden yellow	do	Very sweet	No spoilage after treatment.
4– 7–32	do		Removed from chamber.		6				
4–22–32	Carabao; Malolos, Bulacan	30	1:1000			Green	Hard	Acid	Good appearance.
4–23–32	do	30	1:1000	2	1	do	do	do	Do.
4–25–32	do	29	1:1000	2	3	Yellowish green	Slightly	do	Do.
4–26–32	do	28	1:1000	2	4	Greenish yellow	do	do	Do.
4–27–32	do	27	1:1000	3	5	do	Soft but firm	Slightly sweet	Do.
4–28–32	do	26	Removed		6	Yellow	do	do	Five fruits spoiled.
3–31–32	Pico; Lamao, Bataan	12	1:1000			Green	Hard	Acid	Good appearance.

TABLE 3.—*Treatment of mangoes with ethylene gas*—Continued.

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observation.			
			Conentration of gas.	Length of aëration	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
4–1–32	do	12	1:1000	3	1	Yellowish Green	Hard	Acid	Good appearance.
4–2–32	do	11	1:1000	2.5	2	Greenish yellow	Slightly soft	Slightly sweet	Do.
4–4–32	do	10	1:1000	2	4	Yellow	Soft but firm	do	Do.
4–5–32	do	9	Removed		5	Golden yellow	do	Sweet	No spoilage.
4–26–32	Carabao; Singalong Experiment Station.	100	1:1000			Green	Hard	Acid	Very good appearance.
4–27–32	do	100	1:1000		1	do	do	do	Picked with stem on.
4–28–32	do		1:1000		2	Yellowish green	do	do	Do.
4–29–32			1:1000		3	Greenish yellow	Slightly soft	Slightly sweet	Do.
4–30–32			1:0000		4	do	do	do	Do.
5–1–32					5	do	do	do	Do.
5–2–32			Removed		6	Golden yellow	Soft but firm	Very sweet	No spoilage.

TABLE 4.—*Treatment of lemons with ethylene gas.*

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aëration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
3– 7–32	Thornless, Tanauan	110	1:1000			Green	Hard	Sour	Good appearance.
3– 8–32	do	109	1:1000	2	1	Light yellow	do	do	Do.
3– 9–32	do	109	1:1000	2.5	2	Full yellow	do	do	Do.
3–10–32	do		Removed		3	do	do	do	No spoilage.
11– 4–32	Lemons	8	1:1000			Green	Firm, fine	Very sour	
11– 5–32 (Sunday)	do	8	1:1000	2		Yellowish green	do		
11– 6–32	do		No treatment						
11– 7–32	do	8	1:1000	2	3	4—yellow			
						4—yellowish green			
11– 8–32	do	3	1:1000	2	4	Yellow	Firm, fine		Five spoiled.
11– 9–32	do	3	1:1000	2	5	Yellow	do		
11–10–32	do	3	Removed from chamber.		6	Yellow	Loose, fine	Very sour	One spoiled.

TABLE 5.—*Treatment of lime with ethylene gas.*

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aëration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
7–14–32	Tahiti; local market	100	1:1000			Very green	Hard	Sour	Good appearance.
7–15–32	do	100	1:1000	3	1	Yellowish green	do	do	Do.
7–16–32	do	99	1:1000	3	2	Light yellow	do	do	Do.
7–17–32 (Sunday)	do		No treatment		3				
7–18–32	do	98			4	Full yellow			No spoilage.
11– 4–32	Otahiti lime	21	1:1000			Yellowish green	Loose, rough	Sour bitter, juicy	
11– 5–32 (Sunday)	do	21	1:1000	2		do	do		
11– 6–32	do		No treatment						
11– 7–32	do	21	Removed from chamber.		3	Orange yellow	do	do	No spoilage.
						Green	Firm, fine	Very sour	
11– 4–32	Native lime	10	1:1000			Yellowish green	do		
11– 5–32 (Sunday)	do	10	1:1000	2					
11– 6–32	do	10	No treatment						
11– 7–32	do	10	1:1000	2		do	do		
11– 8–32	do	10	1:1000	2		Pale yellow	do		
11– 9–32	do	10	Removed from chamber.	5		Yellow	do	Very sour, juicy	No spoilage.

TABLE 6.—*Treatment of chicos with ethylene gas.*

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aëration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
3–29–32	Chicos; Polo, Bulacan	90	1:1000			Light brown	Hard	Bitter	Good appearance.
3–30–32	do	90	1:1000	2	1	do	do	do	Do.
3–31–32	do	88	1:1000	2	2	do	Slightly soft	Slightly sweet	Do.
4– 1–32	do	85	Removed		3	Brown	Soft but firm	Very sweet	No spoilage.

TABLE 7.—*Treatment of avocados with ethylene gas.*

Date.	Material. Variety and source.	Quantity.	Treatment.			Daily observations.			
			Concentration of gas.	Length of aëration.	Days.	Color.	Texture.	Flavor.	Remarks.
				Hrs.					
8– 5–32	Cardinal; Tanauan	40	1:1000			Olive green	Hard		Good appearance.
8– 6–32	do	40	1:1000	2	1	Purplish green	Slightly soft	Good	Do.
8– 7–32	do	39	1:1000	2	2	Purplish brown	Soft	do	No spoilage.
8– 8–32	do	39	Removed		3				
8– 5–32	Pollock; Tanauan	32	1:1000			Green	Hard		Good appearance.
8– 6–32	do	32	1:1000		1	do	Slightly soft	Good	Do.
8– 7–32	do	31	1:1000		2	do	Soft	do	No spoilage.
8– 8–32	do	31	Removed		3	do	do	do	Do.
8– 5–32	Layon; Tanauan	20	1:1000			do	Slightly soft	do	Good appearance.
8– 6–32	do	20	1:1000		1	do	Soft	do	Do.
8– 7–32	do	19	Removed		2	do	do	do	No spoilage.

Quarterly Notes

THE NATIONAL RESEARCH COUNCIL OF THE PHILIPPINE ISLANDS

TWO PLATES

Local scientists made a history when, on April 3, 1934, they met at the School of Hygiene and Public Health Building of the University of the Philippines to organize the National Research Council of the Philippine Islands. The aims of the council, as enumerated by Act No. 4120 creating this body, are (1) to stimulate research in the mathematical, physical, and biological sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts, with the object of increasing knowledge, starting studies of problems of the national defense, and of contributing in other ways to the public welfare; (2) to survey the larger possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects; (3) to promote coöperation in research at home and abroad, in order to secure concentration of effort, minimize duplication, and stimulate progress; and in all coöperative undertakings to give encouragement to individual initiative as fundamentally important to the advancement of science; and (4) to gather and collate scientific and technical information at home and abroad, in coöperation with governmental and other agencies, and to render such information available to duly accredited persons.

THE GOVERNOR'S ADDRESS

In the inaugural meeting the Council was presided over by the Acting Secretary of Agriculture and Commerce Jorge B. Vargas, and addressed by Governor General Frank Murphy. Among other things the Governor-General said:

> There is a real place for you in science. There is a real lure in science which every student and every curious-minded person feels, until the struggle for existence drags him from the heights of thought into the march of economic trials.

The search for truth is one of the real joys in life a hard working man wants to have. His mind is restless, he realizes his duties here and he wants to understand the meaning of life, understand himself and understand his fellowmen. In my contact during my existence in the Government with the men who work in a scientific branch of the Government, I have found them to be inconspicuous. There are the men finding scientific plans in the Government, men of the greatest skill, the kind of superb character that makes for good mentality, men who are paid with insignificant remuneration in relation to making the most extraordinary contributions to mankind, and in researches scientific men do much appreciable work in the Government.

I want to state that during my time in these Islands I have found cool and competent men, and that every community has its thinkers, its normal and well-balanced scientific men. This community has that kind of men and I have a great admiration for them. For they think not as they are told to think, but they think independently and distinterestedly, and there is courage behind that kind of thought. Here in the Philippines we have a good rôle of thinkers, not grotesque, not biased, but sound, normal, healthy, and disinterested thinkers, and I think there is a lot of them in the National Research Council.

The fact that you are mustered together, planning to make up this Government through this body a great instrumentality of inquiry and research proves this. That is what the Government should be if its aim is to reveal all the hidden treasures and the possibilities dormant in a nation.

This is a happy hour, it seems to me, in the life of the Insular Government to find whether or not there is any possibility now of systematic and disinterested research and inquiry.

I have often heard it said that when a man is lost in the woods, he has lost himself. This is quite wrong. He is there and he knows it, and he knows that he is lost in relation with the rest of the world. He does not have a fixed point from which to start, and he does not know which direction is north, south, east or west and instinct motivates him to start out in that circle which we so often hear about when he does not know his direction.

That is not only true of an individual but also of a community, and of a people. We must be oriented—find our relation with ourselves—how we stand wtih each other, with the deity—with life. And this body can orient life bravely for us in research, in discovering our natural resources in the Philippines.

The longer I remain in public life the more pronounced become my views about the contribution that individuals and special groups make in a community which tend to make life one of selfishness. This is to be regretted, it is to be deplored. Organizations that are created for the sake of just doing something for themselves are altogether too many.

It seems to me that scientific thought of inquiry and possession can make the solidarity and unity of a people a possibility. That kind of thought is never directed by self-conceit. That kind of thought is motivated by an urge to seek the truth and that which is good for all the people. So, may I suggest to this body, first, that you be jealous of your fraternity in order that one of the first things that you could be interested in might be to discover the possibilities of this country. Keep the ideal of disin-

terested purely scientific research with you always. I am sure that the task is yours to do earnestly. I want to extend to you my congratulations, my hopes for your accomplishements, and to give to you my sincere assurance that the executive branch of the Government will do everything within its power to encourage you, to support you, and to keep you within the strict range of inquiry and activity where I want you to be.

In a subsequent meeting the Research Council adopted the following constitution:

CONSTITUTION AND BY-LAWS

ARTICLE I—*Purposes*

In accordance with the provisions of section 2 of Act No. 4120, the purposes of the National Research Council are:

(1) In general, to stimulate research in the mathematical, physical, and biological sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts, with the object of increasing knowledge, starting studies of problems of the national defense, and of contributing in other ways to the public welfare.

(2) To survey the larger possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects.

(3) To promote coöperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication, and stimulate progress; but in all coöperative undertakings to give encouragement to individual initiative as fundamentally important to the advancement of science.

(4) To gather and collate scientific and technical information at home and abroad, in coöperation with governmental and other agencies and to render such information available to duly accredited persons.

ARTICLE II—*Membership*

SECTION 1. The members of the National Research Council shall not exceed one hundred fifty (150).

SEC. 2. The members appointed by the Governor-General and confirmed by the Philippine Senate in accordance with section 1 of Act No. 4120 shall be considered charter members.

SEC. 3. Members other than charter members shall be elected by the council.

SEC. 4. Membership in the Council shall be limited to citizens of the Philippine Islands or of the United States. This, however, shall not be construed as applying to membership in sections acting under the Council, whose members are not necessarily members of the Council; provided that members of such sections who are not citizens of the Philippine Islands or of the United States shall in no case form a majority of any such Sections.

SEC. 5. Membership in the Council may be lost by death, resignation, or separation for cause.

SEC. 6. Any member intending to leave the Philippine Islands for a period of more than one year shall make it known to the Council in writing

whether or not he intends to return to the Philippine Islands. Any member absenting himself from the Philippine Islands for a period of more than one year without having so signified his intentions of returning shall be considered automatically as having resigned and his membership may be filled by the Council.

SEC. 7. Any member may be separated for cause upon written complaint by ten or more members after due investigation and hearing, and upon the unanimous vote of the members of the Executive Board.

ARTICLE III—*Divisions*

SECTION 1. The Council shall be organized in divisions as follows:

I. Division of government, foreign, and educational relations.
II. Division of physical and mathematical sciences.
III. Division of medical and veterinary sciences.
IV. Division of chemical and pharmaceutical sciences.
V. Division of biological sciences.
VII. Division of engineering and industrial research.
VI. Division of agriculture and forestry.

SEC. 2. The number of divisions and the grouping of subjects in Article III, section 1, may be modified by the Executive Board of the National Research Council.

SEC. 3. The divisions of the Council, with the approval of the Executive Board, may establish sections any of which may include members chosen outside the membership of the Council.

ARTICLE IV—*Administration*

SECTION 1. The affairs of each division shall be administered by a chairman and an executive committee which will be composed of the chairmen of sections. The chairman of each division shall be ex oficio member of the sections under the division.

SEC. 2. The affairs of the National Research Council shall be administered by an Executive Board which shall consist of three members at large and the chairmen of divisions. The chairman of the Executive Board and of divisions of the National Research Council shall continue respectively as members of the Executive Board and corresponding Divisions for one year beyond the expiration of their office as chairmen.

SEC. 3. The Executive Board of the National Research Council shall, for all legal purposes, constitute the Board of Directors with all the duties, powers and prerogatives of a Board of Directors, not otherwise provided for in this Constitution and By-Laws.

SEC. 4. The officers of the National Research Council shall consist of a chairman, a vice-chairman, an executive secretary, and a treasurer, who shall serve also as officers of the Executive Board of the Council. The offices of the executive secretary and the treasurer may be held by the same person.

SEC. 5. The chairman of the National Research Council, or, in case of his absence or inability to act, the vice-chairman, shall be the chief executive officer of the Council; shall preside the meetings of the Council

and of the Executive Board; shall refer investigations required by the Government of the Philippine Islands and other entities to the proper sections.

SEC. 6. The officers of the National Research Council and chairmen of divisions shall hold office for one year or until their successors are legally elected and qualified. A vacancy in the office of executive secretary and treasurer may, however, be filled by appointment by the chairman of the Board until the next meeting of the Board.

SEC. 7. The executive secretary shall take charge of all correspondence and the minutes of the meeting of the Council. It shall be his duty also to give notice to the members of the place and time of all meetings, of all nominations, and of all proposed amendments to the constitution.

SEC. 8. The treasurer shall attend to all receipts and disbursements of the Council. He shall be the custodian of the funds and property of the Council and shall present a general report of the financial status of the Council at the annual meeting.

SEC. 9. The Executive Board shall have the power to appoint fellows, associates and collaborators, fix their duties and their emoluments.

SEC. 10. Other duties of the officers of the Council and the duties of the divisions shall be fixed by the Executive Board.

ARTICLE V—*Nominations and Appointments*

SECTION 1. The Government bureaus or offices and the educational scientific and technical institutions or societies to be represented in the National Research Council, shall be determined by the Executive Board.

SEC. 2. Representatives of the government bureaus or offices shall be nominated by the Secretary of the Department concerned at the request of the Executive Board and appointed by the chairman of the Executive Board to membership in the sections of the Council.

SEC. 3. Representatives of educational, scientific, and technical institutions or societies shall be nominated by the institutions or societies at the request of the Executive Board, and appointed by the chairman of the Board to membership in the sections of the Council.

SEC. 4. Membership in the sections shall be for a term of three years, except when appointed to fill unexpired terms, provided that the members first appointed shall be for periods of one, two or three years.

SEC. 5. The government representatives shall serve for the period of their appointment, provided that if they retire from the government office which they represent, they shall cease to be members of the sections and their successors shall be appointed for the unexpired term.

ARTICLE VI—*Elections*

SECTION 1. New members shall be elected at the annual meeting of the Council upon nomination by the Executive Board. Election shall be by secret vote. No member shall be elected who has received ten negative votes.

SEC. 2. Members of the Executive Board shall be elected by secret ballot at the annual meeting by members of the Council. A plurality of the votes cast for the respective membership in the Executive Board shall elect. The chairmen of each division shall be elected from not less than two nominees

to be selected and submitted by the divisions concerned. The three members at large shall be elected from nominees made at the annual meeting. No cumulative voting will be allowed.

SEC. 3. The officers of the National Research Council shall be elected by the Executive Board as soon as the elected members may be convened and not later than ten days after the date of the annual meeting.

SEC. 4. Membership in the divisions shall be determined by the Executive Board.

ARTICLE VII—*Meetings*

SECTION 1. The annual meeting of the Council shall be held in February in the City of Manila, on a date to be determined by the Board.

SEC. 2. Special meetings of the Council may be called by the Executive Board or upon the request in writing of at least ten (10) members of the Council.

SEC. 3. Notice of Council meetings shall be sent to all members at least ten days before the meeting, provided that for special meeting its purpose must be included with the notice.

SEC. 4. Fifty members present in any meeting of the Council shall constitute a quorum. No proxies will be allowed.

SEC. 5. A majority of the Executive Board shall constitute a quorum for the transaction of any business, provided that at least five days notice of the meeting shall have been given.

SEC. 6. At the annual meeting the order of business shall be as follows:

(1) Call to order by the chairman.
(2) Roll call.
(3) Approval of the minutes of the last meeting.
(4) Chairman's address.
(5) Report of the Executive Board.
(6) Unfinished business.
(7) Miscellaneous.
(8) Election of officers.
(9) New business.
(10) Election of new members.
(11) Adjournment.

ARTICLE VIII—*Publications and Reports*

SECTION 1. The Executive Board of the National Research Council of the Philippine Islands shall submit regularly an annual report to the Philippine Legislature and the Governor-General, through the Department of Agriculture and Commerce, containing an accurate account of its work and activities during the corresponding fiscal year.

SEC. 2. The report of the treasurer and the auditor appointed by the chairman of the council shall be incorporated in the annual report of the Executive Board.

SEC. 3. Publications of the National Research Council may include papers, bulletins, reports, memoirs, which may appear in the proceedings or memoirs of the National Research Council, in the publications of other societies in scientific and technical journals, or in a separate series of the National Research Council.

ARTICLE IX—*Amendments*

SECTION 1. This Constitution and By-Laws may be amended, repealed or altered, in whole or in part, by a two-thirds vote of the members present, at any regular meeting of the Council, or at any special meeting where such action has been announced in the call and notice of such meeting.

SEC. 2. Proposed amendment, repeal or alteration must be submitted in writing to the Executive Board. The Board may amend the proposition or recommend approval or disapproval thereof within thirty days from its receipt. The proposal together with the recommendation of the Executive Board must be sent to all the members of the Council at least twenty days before the date of the meeting at which it is to be considered.

The National Research Council is constituted by the following officers and members:

EXECUTIVE BOARD

CHAIRMAN

Dr. MANUEL L. ROXAS, Under Secretary of Agriculture and Commerce and Commissioner of Research.

VICE-CHAIRMAN

Dr. BIENVENIDO M. GONZALES, Dean of the College of Agriculture, University of the Philippines.

EXECUTIVE SECRETARY AND TREASURER

Dr. PATROCINIO VALENZUELA, Secretary, School of Pharmacy and Associate Professor of Pharmacy, University of the Philippines.

MEMBERS OF THE BOARD

Dr. VICTOR BUENCAMINO, Director of Animal Industry, as Chairman of the Division of Government, Foreign, and Educational Relations.

Rev. MIGUEL SELGA, Director of the Weather Bureau, as Chairman of the Division of Physical and Mathematical Sciences.

Dr. ANTONIO G. SISON, Professor of Medicine, University of the Philippines, as Chairman of the Division of Medical and Veterinary Sciences.

Mr. ANGEL S. ARGÜELLES, Assistant Director, Bureau of Science, as Chairman of the Division of Chemical and Pharmaceutical Sciences.

Dr. EDUARDO QUISUMBING, Chief, National Museum, Bureau of Science and Curator, Philippine National Herbarium, as Chairman of the Division of Biological Sciences.

Mr. ARTHUR F. FISCHER, Director of Forestry, as Chairman of the Division of Agricultural Forestry.

Mr. HERMENEGILDO B. REYES, Professor and Head of Department of Electrical Engineering of the College of Engineering, University of the Philippines * as Chairman of the Division of Engineering and Industrial Research.

* Transferred as of May 1, 1934 to the Department of Agriculture and Commerce, as chief of the Division of Industrial Engineering.

CHARTER MEMBERS OF THE NATIONAL RESEARCH COUNCIL OF THE PHILIPPINE ISLANDS APPOINTED BY THE GOVERNOR-GENERAL

Abello, Dr. Tomas—Physics.
Adams, Mr. Wallace—Fishery.
Adriano, Dr. Felipe T.—Agricultural Chemistry.
Afable, Dr. Valentin—Surgery.
Africa, Dr. Candido M.—Parasitology.
Aguilar, Mr. Rafael—Industrial Chemistry.
Albert, Dr. José—Pediatrics.
Aldaba, Dr. Vicente C.—Textile Industry and Agronomy.
Alicante, Dr. Marcos M.—Soil Technology.
Alvir, Dr. Antonio—Geology.
Argüelles, Dir. Angel S.—Chemical Technology.
Argüelles, Dr. Manuel V.—Bacteriology.
Beyer, Prof. H. O.—Anthropology.
Brown, Dr. William H.—Botany.
Buencamino, Dr. Victor—Veterinary Medicine.
Calderon, Dr. Fernando—Gynecology.
Camus, Dir. José S.—Agronomy—Rice.
Carreon, Dr. Manuel—Psychology and Education.
Clara, Dr. Feliciano M.—Plant Pathology.
Clemente, Dr. Amando—Physical Chemistry.
Clemente, Dr. Leopoldo—Zoölogy.
Concepcion, Dr. Isabelo—Nutrition and Biochemistry.
Copeland, Dr. Edwin B.—Agricultural Botany.
Cruz, Dr. Cornelio C.—Geography.
Curran, Prof. H. M.—Tropical Forestry.
Cuzner, Prof. Harold—Silviculture and Physiography.
Dacanay, Prof. Placido—Forestry.
Domingo, Dr. Elias—Psychiatry.
Eduque, Dr. José—Surgery.
Elicaño, Mr. Victoriano—Mineral Technology.
Espino, Dr. Rafael B.—Plant Nutrition.
Espinosa, Mr. José C.—Industrial Chemistry.
Fajardo, Dr. Tranquilino G.—Plant Pathology.
Faustino, Dr. Leopoldo—Mineral Technology and Geology.
Feliciano, Dr. Jose M.—Geology.
Feliciano, Mr. Ramon—Pharmaceutical Products.
Fischer, Dir. Arthur F.—Forestry.
Fronda, Dr. Francisco M.—Poultry.
Garcia, Dr. Arturo—Anatomy.
Garcia, Dr. Faustino—Pharmacology.
Garcia, Dr. Gumersindo—Tropical Medicine.
Gomez, Dr. Angel K.—Veterinary Medicine.
Gomez, Dr. Liborio—Bacteriology, Pathology and Cancer.
Gonzaga, Prof. Luis—Industrial Chemistry.
Gonzales, Dr. Bienvenido M.—Animal Husbandry.
Guerrero, Dr. Leon Ma.—Pharmacopœia and Medicinal Plants.
Guerrero, Dr. Luis—Tropical Medicine.
Hermano, Dr. Ariston—Nutrition.
Hernando, Dr. Eugenio—Biometrics.
Hyde, Prof. E. R.—Engineering.
Jesus, Dr. Pablo I. de—Tropical Medicine.
Juan, Dr. Timoteo Dar—Industrial Chemistry.
Lantin, Dr. Pedro—Tropical Medicine.
Lara, Dr. Casimiro—Leprosy.
Lara, Dr. Hilario—Hygiene and Preventive Medicine.
Leon, Dr. Walfrido de—Bacteriology, Pathology, and Immunology.
Lopez-Rizal, Dr. Leoncio—Hygiene and Preventive Medicine.
Luce, Dir. R. F.—Geodetic Survey.
Manalang, Dr. Cristobal—Malaria and Leprosy.
Marañon, Dr. Joaquin—Plant Chemistry and Medicinal Plants.
McGregor, Mr. Richard C.—Ornithology.
Mendiola, Dr. Nemesio—Genetics and Plant Breeding.
Merino, Dr. Gonzalo—Economic Entomology.
Miranda, Mr. Luis G.—Refrigeration and Cold Storage.
Montalban, Mr. Heraclio—Ichthyology.
Mundo, Mr. Salvador del—Ceramics.
Nañagas, Dr. Juan C.—Neurology and Anatomy.
O'Bear, Dr. George B.—Physics.
Ocfemia, Dr. Gerardo O.—Plant Pathology.
Otanes, Mr. Faustino Q.—Economic Entomology.
Paguirigan, Mr. D. B.—Agronomy—Tobacco.
Paz, Dr. Daniel de la—Pharmacology.
Pendleton, Prof. Robert L.—Soil Technology.
Quisumbing, Dr. Eduardo—Taxonomy and National Museum.
Quisumbing, Mr. Emilio—Irrigation and Drainage.
Raymundo, Mr. Mariano B.—Plant Propagation.
Reyes, Dr. Carmelo—Cancer.
Reyes, Mr. Francisco D.—Industrial Chemistry (Tests and Standards).
Reyes, Prof. Hermenegildo B.—Engineering.
Reyes, Prof. Luis—Wood Technology and Forest Utilization.
Rosario, Dr. Mariano V. del—Pharmacopœia.
Rotea, Dr. Santiago Y.—Animal Products.
Roxas, Dr. Baldomero—Obstetrics.
Roxas, Dr. Hilario—Fishery.
Roxas, Dr. Manuel L.—Agriculture and Agricultural Chemistry.
Russell, Dr. Paul F.—Malaria.
San Agustin, Dr. Gregorio—Veterinary Medicine.

Santos, Dr. A. C.—Plant Chemistry and Pharmaceutical Products.
Santos, Dr. F. O.—Nutrition and Biochemistry.
Santos, Dr. José K.—Pharmacognosy.
Schwartz, Major S. C.—Tropical Medicine.
Selga, Rev. Miguel—Weather.
Silayan, Mr. Hilarion S.—Agricultural Economics and Extension.
Singian, Dr. Gregorio—Cancer, Surgery, and Radiotherapy.
Sison, Dr. Agerico B. M.—Tropical Medicine.
Sison, Dr. Antonio—Tropical Medicine.
Sumulong, Dr. Manuel D.—Veterinary Medicine.
Tamesis, Dir. Florencio—Forestry.
Tan, Dr. Vidal A.—Mathematics.
Teodoro, Prof. Anastasio—Agricultural Engineering.
Teodoro, Dr. Nicanor G.—Mycology.
Topacio, Dr. Teodulo—Veterinary Medicine.
Torres, Dr. Juan P.—Plant Breeding.
Tubangui, Dr. Marcos—Parasitology.
Uichanco, Dr. Leopoldo B.—Economic Entomology.
Valenzuela, Dr. Patrocinio—Pharmacopœia and Pharmaceutical Products.
Velarde, Dr. Herminio—Ophthalmology. and Otorhinolaryngology.
Vibar, Dr. Toribio N.—Agricultural Education.
Villadolid, Dr. Deogracias—Zoölogy.
Villegas, Prof. Valente—Animal Husbandry.
Wade, Dr. Windsor H.—Leprosy.
West, Dr. Augustus P.—Organic Chemistry.
Yeager, Dr. Clark H.—Hygiene and Sanitation.
Ylanan, Dr. Regino R.—Physical Education.

ILLUSTRATIONS

PLATE 1. Local scientists in the inaugural meeting of the National Research Council of the Philippine Islands.

PLATE 2 (*a*) His Excellency, the Governor-General of the Philippine Islands, Frank Murphy and the Honorable, the Acting Secretary of Agriculture and Commerce, Jorge B. Vargas.

(*b*) Ad interim charter members of the National Research Council of the Philippine Islands taking oath of office.

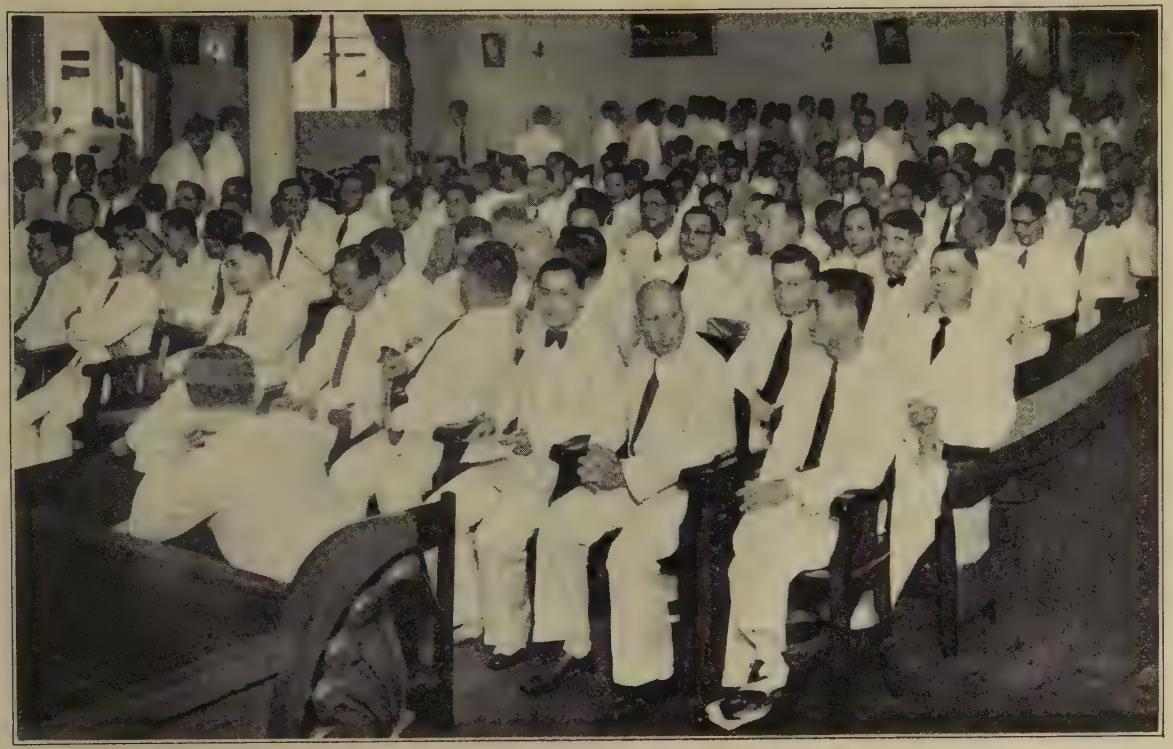
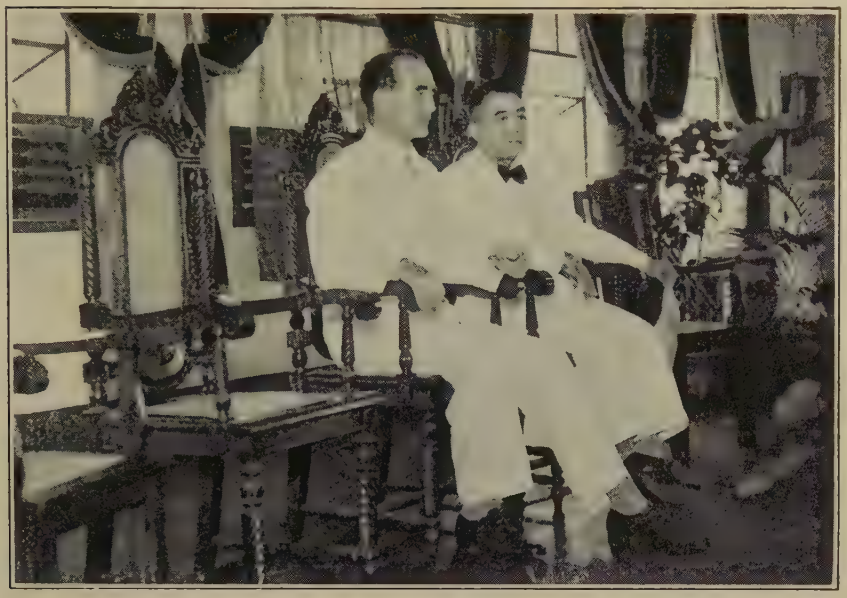


PLATE 1.



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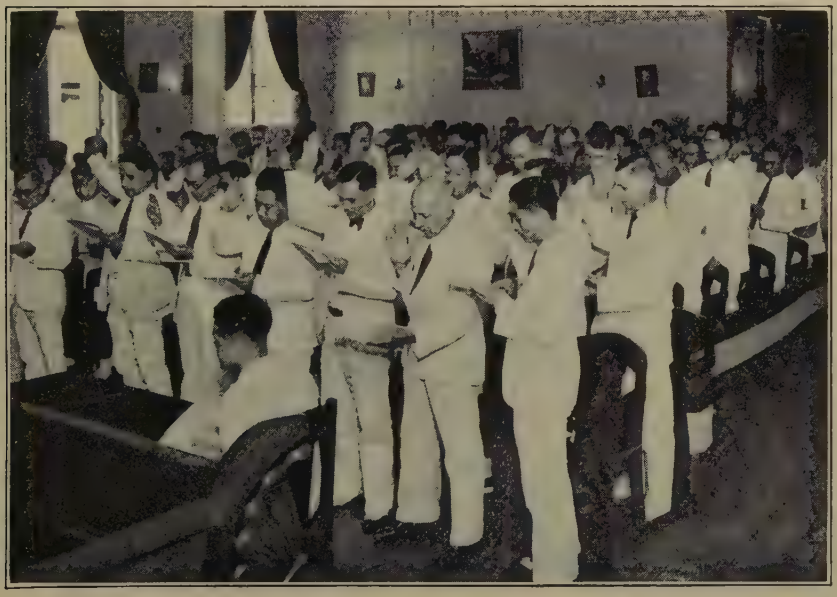

(*b*)

PLATE 2.

BANANA BLACK-TIP DISEASE IN THE PHILIPPINES

ONE PLATE

A disease of banana (*Musa sapientum* Linn.) heretofore apparently unreported from the Philippines was observed for the first time about the outset of the rainy season, while the writer was still connected with the Bureau of Science, Manila, Philippine Islands, in July, 1932. The disease was found quite serious on unripe fruits of banana [*M. sapientium* var. *cinerea* (Blanco) Teodoro], locally known as Latundan or Tordan growing side by side with two other banana varieties, Saba [var. *compressa* (Blanco) Teodoro] and Gloria or Ternate [var. *ternatensis* (Blanco) Teodoro], both of which, to all appearances, seemed unaffected. As no survey has yet been made it has not been possible to state how common the disease is, nor to evaluate the economic importance of this disease at present. Likewise it is not known how long the disease has been present in the Islands. From the appearance of the specimens collected, however, which showed infection in majority of the fingers and in most hands, there seems little doubt of the disease becoming potentially capable of causing considerable injury when favorable conditions obtain for its development.

This disease was first described by Ashby,[1] causing black spot of banana leaf in Jamaica, and tentatively attributed it to *Cercospora musarum* Ashby. Later, Ogilvie, as cited by Wardlaw,[2] described it as the "black-tip" disease of bananas in Bermuda, on Cavendish variety (*Musa cavendishii* Lamb.). It has also been reported in Trinidad, Peru and India, according to Wardlaw,[3] who gave the causal organism a new name, *Helminthosporium torulosum* (Syd.) comb. nov. Ashby. On banana leaves showing black-spot disease collected in Para, Brazil, by the late C. F. Baker, the fungus was named by H. and P. Sydow as *Brachysporium torulosum* nov. spec.[4]

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[1] Ashby, S. F. Banana diseases in Jamaica. Bull. Dept. Agric., Jamaica, Vol. 2, No. 6, pp. 95–128. January, 1913.

[2] Wardlaw, C. W. Notes on "black-tip" disease in Trinidad, Helminthosporium torulosum (Syd.) comb. nov. Ashby. Tropical Agriculture 9, No. 1, pp. 3–6. January, 1932.

[3] Op. Cit.

[4] Sydow, H. & P. Fungi Paraënses. Hedwigia 49, Nos. 2–3, pp. 78–84. October, 1909.

The symptoms of the black-tip disease found on banana (Plate 1, fig. 1) in the Philippines resemble closely those described by other investigators on immature banana fruits in the West Indies. Attempts to culture the organism have been very successful, yielding invariably a species of *Helminthosporium* which produces a dense weft of dark gray growth (Plate 1, fig. 2) on potato glucose agar. In size, color, shape and septation of thick-walled conidia, the characteristic terminal distention of conidiophores, presence of swollen hyphae and elbowed and branched conidiophores (Plate 1, fig. 3) as well as in other more or less interesting characters are entirely similar to *H. torulosum* (Syd.) comb. nov. Ashby, reported by Wardlaw.[5] Further studies on this disease are under way.

—*Gaudencio M. Reyes*

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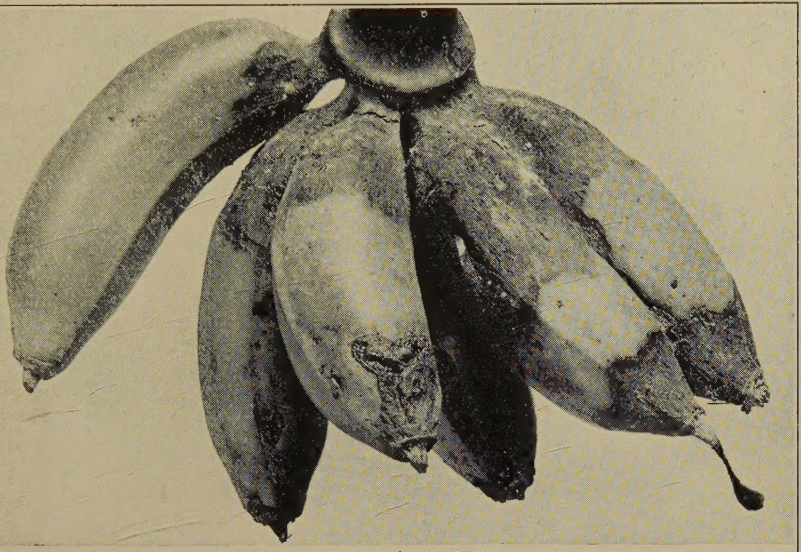
[5] Op. Cit.

ILLUSTRATION

PLATE 1.—(1) A hand of green bananas, Latundan variety, showing typical characteristic features of the black-tip disease at various stages of development about × 0.7; (2) a culture of the causative fungus showing typical *Helminthosporium torulosum* growth on potato dextrose agar about × 0.6; (3) a photomicrograph of the banana black-tip organism showing some distinctive morphological characters; × 102.



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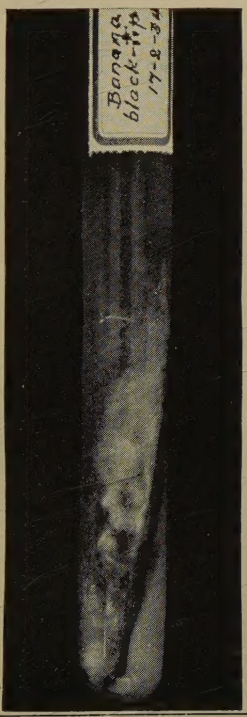
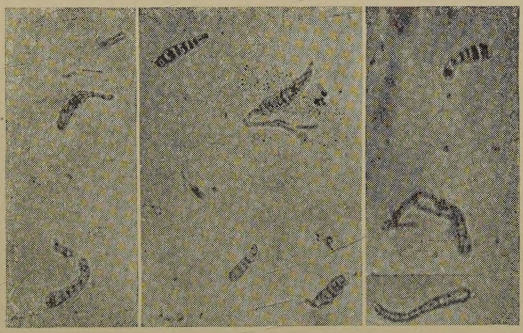


2



3

PLATE 1.

WILLIAM G. FRISBIE

William G. Frisbie, formerly assistant editor of the Philippine Agricultural Review (now the Philippine Journal of Agriculture) and the Philippine Farmer, died at eight o'clock in the morning of April 13, 1934. The deceased came to the Philippines in 1904 as a school teacher. Later he joined the Bureau of Public Works and a few years after, the Bureau of Agriculture as a locust inspector. In 1917, he was made chief of the Division of Publications of the same Bureau. As chief of publications, he was assistant editor of the Agricultural Review and Philippine Farmer. On December 31, 1919, he retired from the Government service under the Osmeña Act, to accept the position of general salesman of the China, Japan and South America Trading Corporation. Subsequently he joined the Philippine Education Co.

Mr. Frisbie was known as a hard worker and hustler. His death is mourned by his many friends and acquaintances.